

STANDARDS DEVELOPMENT BRANCH OMIE



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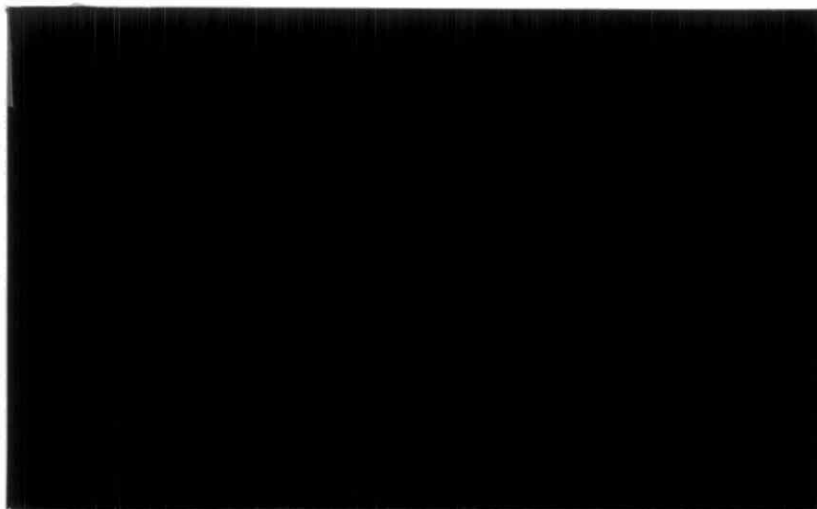
# ENVIRONMENTAL RESEARCH

RESEARCH AND TECHNOLOGY BRANCH



Environment  
Ontario

Jim Bradley, Minister





HC  
117  
.057  
1988

Inventory of research and  
development projects : 1988 /  
20375



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057  
1988

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RESEARCH AND TECHNOLOGY BRANCH  
ENVIRONMENTAL RESEARCH PROGRAM

INVENTORY OF RESEARCH  
AND DEVELOPMENT PROJECTS  
1988

DATE DUE

INVENTORY OF RESEARCH AND DEVELOPMENT PROJECTS

1988

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## INTRODUCTION

The Ontario Ministry of the Environment, Research and Technology Branch publishes the Inventory of Research and Development Projects annually in order to ensure the dissemination of research findings to the environmental scientific community. This document reflects the Ministry's commitment to environmental research through effective allocation of resources in a manner consistent with Ministry policies and priorities.

The inventory presents summaries of research projects funded by the Ministry and being conducted in 1988. It includes research grants and contracts to universities, consultants and other external research institutions and agencies, as well as internal research projects. The summaries are reported according to the sponsoring committee, Branch or Region.

- Research Advisory Committee
- Air Resources Branch
- Hazardous Contaminants Branch
- Laboratory Services Branch
- Waste Management Branch
- Water Resources Branch
- Regions
- Ontario Pesticides Advisory Committee

The views and ideas expressed in the project summaries are those of the principal investigator and do not necessarily reflect the position of the Ministry of the Environment, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

Further information pertaining to the projects may be obtained by contacting the principal investigator or liaison officer involved. Information about the Ministry's Research Management Process may be obtained by contacting:

Research and Technology Branch  
Ontario Ministry of the Environment  
135 St. Clair Avenue West  
Toronto, Ontario  
M4V 1P5

Telephone: (416) 323-4574

RESEARCH ADVISORY COMMITTEE

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RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: The Development of a Freshwater Fish  
Test to Identify Aquatic Toxic Contaminants

PROJECT NO: 64G  
START DATE: 12/82

SHORT TITLE: Aquatic Contaminants/Fish Test

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. I.R. Smith  
Ont. Veterinary College  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. Rokosh

Water Resources Branch  
235-5787

OBJECTIVE(S): The multidisciplinary combination of expertise available within the Ministry and at the University of Guelph will undoubtedly prove productive. The program will primarily be carried out at Resources Road Research Laboratory within the Toxicity Unit, Water Resources Branch, with utilization of the specialized facilities of the Biohazards Laboratory, Microbiology Section, Laboratory Services & Applied Research Branch.

PROJECT DESCRIPTION: The project involves a multidisciplinary approach to develop a test based on structural and functional changes in fish.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	18.2	19.3		37.5
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Work Years:

Budget Source: RAC

KEYWORDS: aquatic contaminants, toxicity, fish test

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited	X
INTERNAL	Grant X	Unsolicited	

PROJECT TITLE: Collaborative Study on Short-Term Tests For Genotoxicity and Carcinogenicity	PROJECT NO: 84G START DATE: 12/82
---	--------------------------------------

SHORT TITLE: Carcinogenicity/Short Term Tests

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. D. Logan Dept. of Biology York University
---	---

LIAISON OFFICER (name, location, telephone no.):	Dr. D. Rokosh Water Resources Branch 235-5787
--	---

OBJECTIVE(S): To examine the adverse effects of a preselected number of hazardous chemicals with respect to their genotoxicity.

PROJECT DESCRIPTION: Data on the genotoxic action of six chemicals selected by MOE will be obtained using the mammalian in vivo bone marrow micronucleus and the mammalian in vivo spermhead abnormality tests.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	60.0	35.2		95.2
	Work Years:				

Budget Source: RAC

KEYWORDS: water carcinogenicity, genotoxicity, short term tests

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited X  
INTERNAL                      Grant                      Unsolicited

PROJECT TITLE: Development of a "Non GC/MS" Oriented Protocol for Routine Analysis of Organic Trace Contaminants in Municipal Wastewater Treatment Plant Raw Sewages and Final Effluents      PROJECT NO: 96C  
START DATE: 08/84

SHORT TITLE: Sewage/Trace Organic Contaminants

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. C. Chan  
Mann Testing Laboratories

LIAISON OFFICER (name, location, telephone no.): T. Ho  
Water Resources Branch  
323-4980

OBJECTIVE(S):

1. To develop a "Non GC/MS" oriented protocol for routine analysis in previously characterized and uncharacterized sewage samples.
2. To document and transfer the protocol to the MOE staff in Laboratory Services & Applied Research Branch.

PROJECT DESCRIPTION: Present analytical procedures are unsuitable by virtue of cost and time for the routine examination of wastewater samples. The needed procedure must be able to analyze for the presence of HOC's in previously uncharacterized samples and be able to trace the fate of selected HOC's during treatment and support in the future a Certificate of Approval compliance program and allow easy analysis of effluent samples.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	100.0	85.5		185.5
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Work Years:

Budget Source: RAC

KEYWORDS: raw sewage, organic trace contaminants analysis

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited X
INTERNAL	Grant	Unsolicited

PROJECT TITLE: Trace Organic Contaminant Removal From Drinking Water	PROJECT NO: 99C START DATE: Mid-85
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SHORT TITLE: Drinking Water

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Mr. John Hilton MacLaren Plansearch
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LIAISON OFFICER (name, location, telephone no.):	K. Roberts Water Resources Branch 323-4881
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OBJECTIVE(S): 1. To assess the effectiveness of both optimized conventional drinking water treatment and activated carbon adsorption (add-on contactor mode) for the removal of trace organic contaminants.  
2. To determine process operational parameters for both systems.

PROJECT DESCRIPTION: Since the project was begun in mid-1985, a number of activities have been ongoing leading to the Phase I report. These are:

1. Selection of target compounds for both the conventional and GAC evaluation phases of the study.
2. Development of analytical methodology to measure target compounds to the low parts per trillion (PPT) level.
3. Development of the detailed experimental plan to monitor performance and minimize analytical requirements.
4. Design of the database management system and statistical data evaluation methodology.

Work is completed on the aspect of:

1. Bench scale testing to optimize coagulant and coagulant aid dosages to achieve maximum organics removal.
2. Pilot equipment set-up and characterization testing of the target compound dosing system and the possibility of adsorption of these compounds on the pilot plant equipment.

The conventional treatment evaluation of Phase II is completed and the Activated Carbon portion of the work is still to be carried out.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	148.7	475.1	262.9	940.9
	Work Years:				

Budget Source: RAC

KEYWORDS: drinking water, trace organics, removal effectiveness, conventional and carbon adsorption treatment

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Progress/Status under review.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Mutagenicity Testing of Leachates  
From Waste Disposal Sites

PROJECT NO: 103C  
START DATE: 09/84

SHORT TITLE: Mutagenicity Testing/Leachates

PRINCIPAL INVESTIGATOR AND AFFILIATION:

G.H. Thomas, D.K. Smith and  
A.J. Horton  
Ontario Research Foundation

LIAISON OFFICER (name, location, telephone no.):

D. Rokosh  
Water Resources Branch  
235-5787

OBJECTIVE(S): To develop methods based on the Ames Salmonella Mutagenicity Assay to detect potentially harmful contamination of groundwater supplies by genotoxic substances leached from landfill sites.

PROJECT DESCRIPTION: A selection of chemical compounds (suspected/known mutagens) exhibiting different functional group features and representing a wide range of polarity in order to develop and validate methods for the collection of organic extract concentrates from both groundwater and site matrix materials. The extracts must be suitable for use in the Ames bioassay systems. The demonstration of the application of the methodology for the collection of organic concentrates of groundwater and site matrix materials from a representative area within a selected landfill site. The various extracts will be evaluated for mutagenic activity. By comparison of the mutagenicity found in the matrix extracts, it may be possible to develop an index of leachability for mutagenic material that can be related to the mutagenicity found in the associated groundwater.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	150.0	125.0	25.0	300.0
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Work Years:

Budget Source: RAC

KEYWORDS: mutagenicity, concentration methods, Ames Test, groundwater

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986, paper Technology Transfer 1987 (BPI), progress report 1988

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Contaminant Mobilization and Uptake  
from Mine Tailings at Cobalt, Ontario

PROJECT NO: 108C  
START DATE: 10/83

SHORT TITLE: Mine Waste/Contaminant Mobility

PRINCIPAL INVESTIGATOR AND AFFILIATION:

E. Hanna  
J.E. Hanna Associates

LIAISON OFFICER (name, location, telephone no.): W.A. Scheider

Water Resources Branch  
323-4925

OBJECTIVE(S): To determine the mobility and bioavailability of contaminants, primarily heavy metals, in mine tailings under varying moisture and chemical regimes.

PROJECT DESCRIPTION: Field monitoring of tailings in Cobalt under varying hydrological, chemical, and biological conditions will be undertaken to characterize the types, concentrations, and fluxes of heavy metals with particular attention to the experimental artificial marsh system.

Laboratory experiments will be used to ascertain the leachability of soil contaminants under varying chemical conditions and the bioavailability of contaminants in sampled waters.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	49.4	8.5			57.9
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Work Years:

Budget Source: RAC

KEYWORDS: mine tailings, contaminants, mobilization, heavy metals

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Growth-Lipid Deposition Relationships  
in Juvenile Cyprinids and Yellow Perch

PROJECT NO: 125G  
START DATE: 03/84

SHORT TITLE: Growth-Lipid Deposition Relationships

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. J.W. Hilton  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. Rokosh

Water Resources Branch  
235-5787

OBJECTIVE(S):

1. Review literature on growth-lipid deposition relationships.
2. To document interrelationships re climate, food, environmental factors on growth-lipid deposition.

PROJECT DESCRIPTION: Determine whether climatic changes and food supply significantly alter growth rates and lipid stores in the fish and therefore alter contaminant accumulations.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	2.0			2.0
	Work Years:	0.1			0.1

Budget Source: RAC

KEYWORDS: cyprinids, yellow perch, growth-lipid deposition

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Listowel Artificial Marsh

PROJECT NO: 128C  
START DATE: 04/84

SHORT TITLE: Sewage Treatment/Listowel Marsh

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Town of Listowel

LIAISON OFFICER (name, location, telephone no.): W. Lewandowski  
Water Resources Branch  
323-4984

OBJECTIVE(S): To investigate the efficiency of and feasibility of year round marshland treatment of waste water. To provide guidelines for design and operation. To study roles of various marsh components

PROJECT DESCRIPTION: Construction of an experimental marsh facility next to the Town of Listowel sewage works. Test efficiency of operation using different marsh designs, eg. chemical vs. shallow. Different pre-treatment types of effluent will be used as feed. Operation will be year round.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	47.5	24.5		72.0
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Work Years:

Budget Source: RAC

KEYWORDS: waste treatment, artificial marsh

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Use of a Special Protein Adsorbent                      PROJECT NO: 135G  
for the Selective Accumulation of Trace Contaminants                      START DATE: 03/84

SHORT TITLE: Protein Adsorbent

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Drs. C.J. Hsia & D.O. Tinker  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): O. Meresz  
Laboratory Services Branch  
235-5762

OBJECTIVE(S): To determine if particular body proteins such as AFP can be used  
as a method of concentrating traces of organic contaminants for analysis.

PROJECT DESCRIPTION: AFP is known to bind polyunsaturated fats in humans.  
Similar compounds circulate in the blood stream of the fetus. DES is known to  
bind to an accumulate on AFP. It is proposed to apply the technique to  
laboratory concentration of trace organics.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	32.0			32.0
	Work Years:	1.0			1.0

Budget Source: RAC

KEYWORDS: protein adsorbent, bioaccumulation, trace contaminants

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Biological Phosphorus Removal

PROJECT NO: 137C  
START DATE: 06/84

SHORT TITLE: Phosphorus Removal

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Canviro Consultants

LIAISON OFFICER (name, location, telephone no.): H. Kronis

Water Resources Branch  
323-4896

OBJECTIVE(S): To investigate the feasibility of implementing Bardenpho biological phosphorus removal at Great Lakes sewage treatment plants based on information gained in the operation of a full-scale biological phosphorus removal plant funded by Environment Canada at Kelowna, B.C.

PROJECT DESCRIPTION: The possibility of retrofitting the Bardenpho process to several activated sludge process configurations used in Ontario plants will be investigated, and detailed estimates for hardware modifications and annual operating costs developed. These will be compared to existing operating costs for the activated sludge plants providing integrated chemical precipitation for phosphorus removal.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	20.0				20.0
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Work Years:

Budget Source: RAC

KEYWORDS: phosphorus, biological removal, sewage treatment

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Environment Canada \$55K.

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Integrated Pest Management on Field  
Corn: A Feasibility Study

PROJECT NO: 138G  
START DATE: 07/84

SHORT TITLE: Pest Management/Field Corn

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Wayne Roberts  
OMAF

LIAISON OFFICER (name, location, telephone no.): J. Lucas

Hazardous Contaminants Branch  
323-5111

OBJECTIVE(S):

1. To define the scope of the problem through a one year survey of the pest complex (insects and weeds) in field corn;
2. To evaluate available monitoring techniques with emphasis on combining various methods into a total program suitable for Integrated Pest management;
3. To demonstrate the capability of making cost-effective Integrated Pest Management decisions for field corn.

PROJECT DESCRIPTION: Approximately 1/2 of the 0.8M hectares of field corn grown annually in Ontario are treated with insecticides for rootworm control. Previous studies have shown that this extent of pesticide usage is unwarranted, but a suitable data base for evolving an Integrated Pest Management approach is unavailable. The present study would therefore monitor some 20 field sites for both weeds and insects. Monitoring techniques presently recommended for each pest would be evaluated. Research inputs from Agriculture Canada and the University of Guelph, combined with the survey data, would then be used to evaluate the effectiveness and reliability of an IPM program for field corn.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	4	TOTAL
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Cost: (\$000's):	65.4	75.5	80.9	74.7	296.4
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Work Years:

Budget Source: RAC

KEYWORDS: pest management, insects, weeds, field corn

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Synthesis of Chlorinated Azobenzenes

PROJECT NO: 146C  
START DATE: 06/84

SHORT TITLE: Chlorinated Azobenzenes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. N. Bunce  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): O. Meresz

Laboratory Services Branch  
235-5762

OBJECTIVE(S): To synthesize chlorinated azobenzenes of high purity for use as analytical standards in MOE laboratory.

PROJECT DESCRIPTION: Seven chlorinated azobenzene compounds will be prepared, purified and tested and supplied in sufficient quantities for MOE use.

The validity and capability of analyses in MOE laboratory depends on the quality and availability of high purity chemicals.

BUDGET AND  
RESOURCES:

Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):	4.092			4.092
Work Years:	0.16			0.16

Budget Source: RAC

KEYWORDS: chlorinated azobenzenes, synthesis, standards

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Development and Validation of Protocols for Sampling Surface and Groundwaters for Volatile Organic Contaminants PROJECT NO: 148G START DATE: 07/84

SHORT TITLE: Volatile Organic Contaminants

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. J. Barker  
Dept. of Earth Sciences  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): T. Yakutchik

Water Resources Branch  
323-4882

OBJECTIVE(S): To evaluate water sampling techniques presently used for volatile organic contaminants and develop improved methods and validate them.

PROJECT DESCRIPTION: A group of volatile organic compounds will be selected to test present ground and surface water sampling techniques. New methods will be developed to alleviate losses due to volatilization and other possible sampling bias using sorption resins.

The project will provide the Ministry with reliable means of sampling natural water. This is especially important for sampling groundwater near landfills.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		9.7	11.9		21.6
Work Years:		0.25	0.25		0.25

Budget Source: RAC

KEYWORDS: surface water, groundwater, sampling, volatile organics

OUTPUT (papers, presentations, reports): Paper: Fall 1987 Ground Water Monitoring Review

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant      X                      Unsolicited X

PROJECT TITLE: The Fate of Hazardous Organic Compounds in Municipal Water Pollution Control Plants      PROJECT NO: 149G  
START DATE: 07/84

SHORT TITLE: Organic Compounds

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      G. Henry & D. Mackay  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): T. Ho  
Water Resources Branch  
323-4980

OBJECTIVE(S): To develop a model and protocol for the prediction of fate of hazardous organic compounds in municipal water pollution control plants.

PROJECT DESCRIPTION: Literature will be reviewed, analytical methods developed for a selection of hazardous chemicals, and a laboratory model simulating a municipal wastewater treatment system will be constructed. The latter will be tested and used to study the fate of hazardous contaminants in control and actual wastewater samples. The refined model will be applied to data obtained from a full-scale plant.

The present study complements several related studies now in progress such as: hazardous contaminants in WPCP in Hamilton, development of a routine protocol for wastewater analyses, etc.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	19.0	20.0	21.0	60.0
	Work Years:	1.1	1.1	1.1	3.3

Budget Source: RAC

KEYWORDS: organic pollutants, water pollution, municipal waste

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference 1986

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Development of Predictive Organic Contaminants Structure-Property-Toxic Relationships for Aquatic Organisms

PROJECT NO: 150G  
START DATE: 07/84

SHORT TITLE: Aquatic Organisms

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. D. Mackay  
Dept. of Chemical Engineering  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): John Ralston  
Water Resources Branch  
323-4924

OBJECTIVE(S): To develop methods to correlate organic contaminant structure to its physical properties, organism uptake rates and toxic effects.

PROJECT DESCRIPTION: The physical properties of a wide selection of organic compounds (30-50) will be correlated to their molecular structure and toxicity levels. The latter will be extended to include bioassays. The findings will be extended to link with MOE toxicity data on both individual and mixtures of hazardous chemicals.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	19.0	19.0	19.0	57.0
	Work Years:	1.1	1.1	1.1	3.3

Budget Source: RAC

KEYWORDS: organic pollutants, biotoxins, aquatic microorganisms

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Development of Sampling and Measuring Techniques to Determine Correlation and Mobility of Volatile Hydrocarbons in Groundwater and Leachates  
PROJECT NO: 151G  
START DATE: 07/84

SHORT TITLE: Volatile Hydrocarbons in Groundwater and Leachates

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. W. Gorman  
Dept. of Geological Science  
Queen's University

LIAISON OFFICER (name, location, telephone no.): H. Tosine  
Laboratory Services Branch  
235-5906

OBJECTIVE(S): To develop a reliable sampling technique that will preserve volatile hydrocarbons in groundwater and leachates using Gloucester Township landfill as a test site.

PROJECT DESCRIPTION: A sampling protocol will first be developed and tested in the laboratory prior to its use at Gloucester Landfill site. Well water will be sampled and the mobility of selected volatile hydrocarbon compounds will be determined and compared to laboratory data. Contingency and analytical support will be provided by the Natural Hydrology Research Institute, Environment Canada. This project will establish a reliable protocol for use by MOE for groundwater sampling and landfill projects.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		25.2	5.25		30.75
Work Years:					

Budget Source: RAC

KEYWORDS: volatile hydrocarbons, sampling, groundwater, leachates

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Environment Canada

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: The Effects of Tile Drainage and Open Ditches on Peak Flows and Dry Weather Flows

PROJECT NO: 152G  
START DATE: 11/84

SHORT TITLE: Peak Flows

PRINCIPAL INVESTIGATOR AND AFFILIATION:

W. Edgar Watt  
Dept. of Civil Eng.  
Queen's University

LIAMSON OFFICER (name, location, telephone no.): Lloyd Logan  
Water Resources Branch  
323-4984

OBJECTIVE(S): To assess the effects of tile drainage and open ditches and dry weather flows with particular application to Ontario.

PROJECT DESCRIPTION: A simulation model for tile-drained agricultural fields and basins will be developed and evaluated. The developed technique will be used to study tile drained fields in the South Nation River.

The study will provide an improved tile drain design that reduces erosion and produces information necessary for the development of drainage guidelines.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		22.0	23.6	25.0	70.6
Work Years:		1.5	1.4	0.9	3.8

Budget Source: RAC

KEYWORDS: drainage systems

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985, Poster presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Laboratory and Numerical Model Studies  
to Design Criteria for Optimal Recovery of Leachate  
Under Sanitary Landfills

PROJECT NO: 153G  
START DATE: 09/84

SHORT TITLE: Leachate Recovery

PRINCIPAL INVESTIGATOR AND AFFILIATION: R.N. Farvolden, R.W. Gillham  
and E.O. Frind  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): M. Goodwin  
Waste Management Branch  
323-5217

OBJECTIVE(S) :

- Evaluation of tile drain systems as a method for leachate capture and development of criteria for their design.
- Development of criteria for overall design of landfills to enhance leachate capture.

PROJECT DESCRIPTION: To modify a scaled physical model landfill to simulate the effects of tile configuration on leachate capture and migration for different settings including clay liners under varying simple but realistic hydrogeologic and climatic conditions.

To test a numerical model for conditions tested physically and extend model to account for anisotropy and simple layered media and use the model to evaluate and predict effectiveness of leachate capture for various tile configurations and hydrogeologic settings.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		30.7	36.9	39.5	107.1
Work Years:		0.3	0.3	0.3	0.9

Budget Source: RAC

KEYWORDS: sanitary landfill, subterranean water

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985 and 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: The Assessment of a Point Source  
Discharge of Suspected Mutagenic and Carcinogenic  
Contaminants: An Epidemiological Approach

PROJECT NO: 157G  
START DATE: 06/85

SHORT TITLE: Mutagenic and Carcinogenic Contaminants

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. I.R. Smith  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. Rokosh

Water Resources Branch  
235-5787

OBJECTIVE(S): To develop methodologies and assess mutagenic and carcinogenic effects on fish.

PROJECT DESCRIPTION: Techniques will be developed for sampling and testing adult and young-of-the-year fish exposed to waters contaminated with industrial wastes for genotoxic, mutagenic and carcinogenic damage.

This subject has lately received public and scientists' attention.

The additional funds (\$14,000) will be used for completion of the previously approved Project No. 157PL.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	40.0	14.0		54.0
	Work Years:				

Budget Source: RAC

KEYWORDS: mutagenicity, carcinogenicity, point source discharge, epidemiology

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Aquatic Toxicity Studies of Multiple Organic Compounds	PROJECT NO: 159G START DATE: 06/84
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SHORT TITLE: Aquatic Toxicity/Organic Compounds

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. G. Ozburn Dept. of Biology Lakehead University
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LIAISON OFFICER (name, location, telephone no.):	J. Ralston Water Resources Branch 323-4924
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OBJECTIVE(S): To provide toxicological data in support of provincial water quality objectives using a selected number of organic compounds both individually and in mixtures.

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PROJECT DESCRIPTION: Laboratory fish will be exposed to a pre-selected number of hazardous chemicals and chronic toxicity and bioconcentration data be produced for both individual compounds and their mixtures.

MOE funding of a completed project has assisted in establishing a recognized centre of excellence in fish toxicity at Lakehead and provided the Ministry with information required by Water Resources and Hazardous Contaminants Branches.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	25.0	65.0	90.0
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Work Years:

Budget Source: RAC

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KEYWORDS: water quality objectives, aquatic toxicity, organic compounds, fish

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies): HCCB, WRB, LSB, Federal Government

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COMMENTS: Research completed; awaiting final report.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

# RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X Contract Solicited  
INTERNAL Grant X Unsolicited X

PROJECT TITLE: Development of a Methodology for Use of Freshwater Clams as a Biological Response System to Monitor the Nearshore Environment of the Lower Great Lakes  
PROJECT NO: 162G  
START DATE: 08/84

SHORT TITLE: Freshwater Clams

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Roger H. Green  
Department of Zoology  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): P.B. Kauss  
Water Resources Branch  
323-4952

## OBJECTIVE(S):

1. To select biological response variables related to molluscs in Lake Erie.
2. To identify analytical methods and contaminants, and evaluate the use of bivalve mollusc shells to generate time-profile environmental impact data.
3. To develop statistical models which predict biological response from environmental quality.
4. To assess the generality of the developed models at several locations and assess genetic components of the biological response.

PROJECT DESCRIPTION: Conduct field studies in the Long Point Bay area to establish the dominant mollusc species and environmental and biological gradients. Genetic and morphological variability will be determined for various mollusc species from this area and some contaminated sites. Analytical methods for shell constituents will be evaluated. Predictive models which relate responses of bivalve molluscs to environmental gradients and quality will be developed and tested.  
The study will provide the Ministry with an inexpensive, long-term method for assessing the quality of Great Lakes nearshore environment using molluscs for bio-monitoring.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	31.4	24.4	17.6	73.4
	Work Years:	0.4	1.5	1.1	3.0

Budget Source: RAC

KEYWORDS: biological monitoring, molluscs and crustaceans

OUTPUT (papers, presentations, reports): Presented - 1986 Technology Transfer Conference. Several other publications are available on request from the investigator.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Syntheses of Oxygen and Sulphur PAHs of Interest in Environmental Pollution and Toxicology	PROJECT NO: 170G START DATE: 08/84
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SHORT TITLE: Environmental Pollution

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	E. Lee-Ruff Department of Chemistry York University
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LIAISON OFFICER (name, location, telephone no.):	O. Meresz Laboratory Services Branch 235-5762
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OBJECTIVE(S): To prepare polynuclear aromatic hydrocarbon compounds for use as chemical standards in the analysis of air particulate matter.

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PROJECT DESCRIPTION: A method will be developed for the preparation of PAH, furans and related hazardous compounds. The method will be extended to the preparation of thiophenes and other chemicals suspected in emission sources from coal, municipal incineration and diesel engines.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	13.0	10.0	10.5	33.5
	Work Years:	1.1	1.1	1.1	3.3

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Budget Source: RAC

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KEYWORDS: toxicology, hydrocarbon compounds, air pollution

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OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985 and 1986.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Research completed; awaiting final report.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Fish Samples in Support of Project PROJECT NO: 174C  
No. 67 RR - 'Revised Monitoring Scheme for Persistent START DATE: 08/84  
& Toxic Organics in Great Lakes Sports Fish'

SHORT TITLE: Fish Sampling/Great Lakes

PRINCIPAL INVESTIGATOR AND AFFILIATION: John Neil  
Limnos Limited

LIAISON OFFICER (name, location, telephone no.): J. Ralston  
Water Resources Branch  
323-4924

OBJECTIVE(S): To provide fish for analysis for Project No. 67 RR with Zenon  
Environmental.

PROJECT DESCRIPTION: The fish were originally to come from the Ministry of  
Natural Resources; but are unobtainable from this source.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	9.4			9.4
	Work Years:				

Budget Source: RAC & WRB

KEYWORDS: fish sampling, great lakes (Project 67)

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Microwave Digestion of Environmental      PROJECT NO: 175G  
Materials Prior to Inorganic Analysis                      START DATE: 10/84

SHORT TITLE: Microwave Digestion/ICP Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. C.J. Mackay  
   Ryerson Polytechnical Inst.

LIAISON OFFICER (name, location, telephone no.): D. Boomer  
   Laboratory Services Branch  
   235-5858

OBJECTIVE(S): To develop new methods for dissolution of solid environmental  
samples such as sediments, soils, minerals, etc. prior to ICP multi-element  
analysis.

PROJECT DESCRIPTION: A microwave energy source will be used to bring complex  
samples into dissolution. Various power levels, times and reagents will be  
tested. The solutions and any remaining residues will be analyzed to determine  
the efficiency of metal extraction.

The developed technology will be transferred to the Ministry and will improve  
laboratory productivity.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	9.4				9.4
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Work Years:

Budget Source: RAC

KEYWORDS: solid samples, dissolution, microwave digestion, ICP analysis

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Application of Taga 6000 Method in  
the Measurement of Dioxin and Furan Emissions at  
Municipal Solid Waste Incinerators

PROJECT NO: 177C  
START DATE: 01/85

SHORT TITLE: Taga Dioxins

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. B. Sushan  
SCIEX (Divison of MDS Health  
Group Ltd.)

LIAISON OFFICER (name, location, telephone no.):

V. Ozvacic  
Air Resources Branch  
965-5770

OBJECTIVE(S): To assess cost effectiveness and practicality of a methodology  
to rapidly determine dioxins and furans at municipal solid waste  
incinerators.

PROJECT DESCRIPTION: Apply and validate an alternative method for analyzing  
PCDD and PCDF in fly ash and air emission samples and compare with  
conventional methods.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	129.5	11.5		114.0
	Work Years:				

Budget Source:

KEYWORDS:

OUTPUT (papers, presentations, reports): Paper presented at Technology  
Transfer Conference, 1985 and 1986

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Research completed; awaiting final report.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Applying New Technology For  
Defluoridation of Water Supply Systems

PROJECT NO: 180C  
START DATE: 03/85

SHORT TITLE: Defluoridation

PRINCIPAL INVESTIGATOR AND AFFILIATION:

P.J. Halliday  
Senior Process Chemist  
Proctor & Redfern Group

LIAISON OFFICER (name, location, telephone no.): J. Dart

Water Resources Branch  
323-4876

OBJECTIVE(S): Review the literature and evaluate, on a pilot plant scale, the use of activated alumina for the removal of fluoride under various temperature, flow and regeneration conditions including reverse osmosis.

PROJECT DESCRIPTION: The study will 1) take American defluoridation of potable water supply data and extrapolate it on Canadian conditions of treatment and waste disposal;

- 2) carry out a literature review and limited on-site pilot tests on elevated-fluoride well water;
- 3) compare two treatment choices - an activated alumina bed and a reverse osmosis unit - in two-week long pilot tests;
- 4) Estimate design requirements and projected treatment costs from the trials to show the equivalent economics for the two options.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	5.0	13.0			18.0
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Work Years:

Budget Source: RAC

KEYWORDS: municipal water distribution systems, fluorides

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Comprehensive Analysis of Activated  
Sludge Aeration Devices Including Health-Related  
Factors

PROJECT NO: 181C  
START DATE: 12/84

SHORT TITLE: Solid Waste/Sludge Aeration Devices

PRINCIPAL INVESTIGATOR AND AFFILIATION:

J. Ganczarczyk  
J. Ganczarczyk & Associates

LIAISON OFFICER (name, location, telephone no.): B. Cooper

Approvals Branch  
440-3568

OBJECTIVE(S): Activation sludge aeration devices will be evaluated, including health-related factors, and guidelines for the selection of appropriate devices will be recommended for specific wastewater treatment plants.

PROJECT DESCRIPTION: Factors affecting the selection of aeration devices, such as stripping and cooling ability, formation of aerosols, and noise characteristics, in addition to oxygenation capacity and cost, will be assessed.

The impact of use of these devices on the health of treatment plant personnel and neighbouring communities will also be evaluated. The study would provide guidelines for Ministry approval procedures of aeration devices.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	9.3				9.3
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Work Years:

Budget Source: RAC

KEYWORDS: activated sludge, aeration devices, selection health factors

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Pre-Feasibility Study on "Expansion  
and Upgrading of Port Dover Sewage Facilities"

PROJECT NO: 185C  
START DATE: 01/85

SHORT TITLE: Sewage Facilities/Port Dover

PRINCIPAL INVESTIGATOR AND AFFILIATION:

J.M. Rosberry  
MacLaren Engineering

LIAISON OFFICER (name, location, telephone no.): W. Ramsden

Project Engineering Branch  
440-3798

OBJECTIVE(S): To develop a cost-effective program for expanding and upgrading  
the existing sewage treatment facility.

PROJECT DESCRIPTION: An innovative approach to conventional secondary  
treatment and sludge disposal processes will be evaluated in detail. This  
approach involves the development of a tree farm in the Port Dover area which  
will be irrigated by sewage from the Port Dover Plant. Use of sludge from the  
plant will also be evaluated.

Benefits to MOE:

- 1) decrease pollutant load to Long Point Bay,
- 2) use of nutrients in sewage for tree growth,
- 3) production of useful material.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	50.0			50.0
	Work Years:				

Budget Source: RAC (30.0), ENV APR (10), Haldimend-Norfolk (10)

KEYWORDS: Port Dover Sewage Facilities, secondary treatment sludge disposal,  
tree farm irrigation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Refuse Pyrolysis Emissions Testing

PROJECT NO: 191G  
START DATE: 02/85

SHORT TITLE: Refuse Pyrolysis Emission

PRINCIPAL INVESTIGATOR AND AFFILIATION:

EFW Systems Inc.  
Ministry of Energy

LIAISON OFFICER (name, location, telephone no.): W. Ng

Waste Management Branch  
323-5128

OBJECTIVE(S): To characterize emission gases from an experimental municipal waste pyrolysis system, developed by EFW Systems of Markham, Ontario.

PROJECT DESCRIPTION:

1. MOE's refuse-derived fuel will be burned in the pyrolysis system at 870°C.
2. MOE specified tests of pyrolysis gases include tests for particulate material, trace metals, acid gases, dioxins and furans, PCB's, PAH's, combustible and inert gases.
3. Physical characteristics such as flowrate, temperature, pressure, and molecular weight will be analyzed.
4. Testing program to be conducted by ORF.

BUDGET AND  
RESOURCES:

Year: (\* current)

1

2

3

TOTAL

Cost: (\$000's):

30.0

30.0

Work Years:

Budget Source: RAC

KEYWORDS: refuse-derived fuel, waste pyrolysis system, emission gases

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Ministry of Energy \$30K, EFW Systems Inc. \$7.5K.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Monitoring the Chemical and Biological Impact, as Measured by Physiological Stress in Fish, of Episodic Events of Acid Precipitation and Snow Melt  
PROJECT NO: 197G  
START DATE: 04/85

SHORT TITLE: Acid Precip./Snowmelt

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Harold H. Harvey  
Professor of Zoology  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): Dr. P.J. Dillon  
Dorset Research Centre  
(705) 766-2412

OBJECTIVE(S): To determine if the observed perturbations of fish populations in MOE calibrated lakes Crosson and Heney are related to the observed pH depressions in these lakes during episodic acid loading. To determine if the observed physiological stress and mortality of fish at Plastic Lake and Milford Bay occur in other waters susceptible to acidification. To use the resulting data in acid loading models and to relate specific acid loading events to both sources of SO<sub>2</sub> and NO<sub>x</sub>, and to effects on the biota.

PROJECT DESCRIPTION: It is proposed that endemic white suckers and hatchery rainbow trout be held at several sites and depths in lakes Croson and Heney. The fish will be monitored for stress by measuring blood and muscle ions at intervals, before, during and after acid pulses from rain and snow events. Water chemistry, including Al speciation, will be determined concurrently. Subsequently this in situ toxicity testing will be extended to other lakes in the Black River drainage which are susceptible to acidification. The results will help to define how widespread are the Plastic Lake phenomena of fish kills and fish stress.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		20.1	20.8		40.9
Work Years:		1.2	1.2		2.4

Budget Source: RAC

KEYWORDS: acid precipitation, fish, physiological stress

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Humber River/Black Creek: Detailed Bacteriological Water Quality Study Examining the Impact of Sediment and Survival Times	PROJECT NO: 198G START DATE: 04/85
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SHORT TITLE: Humber River/Black Creek

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. P. Seyfried University of Toronto
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LIAISON OFFICER (name, location, telephone no.):	Z. Novak Water Resources Branch 323-4804
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OBJECTIVE(S): 1) To determine the extent of bacterial exchange between sediment and water as a result of resuspension of sediment.  
2) To determine survival times of fecal indicator bacteria in the Humber River environment.  
3) To provide information required for methods being developed for inferring original sources of fecal pollution by identifying bacteria present at study sites.  
4) Determining loadings, potential for sediment transport and deposition capacity of different source types.

PROJECT DESCRIPTION: To examine loadings and the effect of sediment resuspension, samples will be obtained at, above and below 5 different source inputs for 2 different conditions - undisturbed and agitated sediments. Levels of all fecal indicator bacteria currently employed in surveys by the Ministry will be assessed as well as sediment content. Meteorological and flow conditions will also be determined.

To assist in the development of a method for tracing and identifying sources of fecal pollution fecal streptococci will be isolated and identified in conjunction with the above study. Information on populations present will be interpreted along with data currently being obtained on the fecal streptococcal populations in human and non-human feces.

Survival times of fecal indicator bacteria will be determined in environmental testing chambers designed for this purpose. Studies will be conducted in situ at each of the five locations.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	98.0			98.0
	Work Years:	5.0			5.0

Budget Source: RAC

KEYWORDS: bacteriology, fecal indicator bacteria, sediment

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

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PROJECT TITLE: Bioaccumulation of Mercury by Yellow Perch      PROJECT NO: 199G  
START DATE: 04/85

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SHORT TITLE: Mercury in Perch

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PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. D.J. McQueen  
Department of Biology  
York University

LIAISON OFFICER (name, location, telephone no.): K. Suns  
Water Resources Branch  
235-5798

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OBJECTIVE(S): To develop a model for the bioaccumulation of mercury in young-of-the-year yellow perch. The model will be used to explain inter-lake variation in mercury body burdens.

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PROJECT DESCRIPTION: Three Precambrian Shield lakes in the Dorset area will be sampled to obtain:  
1) the data required to develop a mercury bioaccumulation model;  
2) seasonal data on net accumulation of mercury by yellow perch through their first year of life.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	29.0			29.0
	Work Years:	0.7			0.7

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Budget Source: RAC

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KEYWORDS: fish, mercury, bioaccumulation

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: PAH Analysis of Environmental Samples      PROJECT NO: 200G  
at Low Temperature Using Fluorescence Detection      START DATE: 04/85

SHORT TITLE: PAH Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Drs. S.V. Filseth, F.J.  
   Morgan and C.M. Sadowski  
   Faculty of Science  
   York University

LIAISON OFFICER (name, location, telephone no.): G. Crawford  
   Laboratory Services Branch  
   235-5757

OBJECTIVE(S): To develop a method for PAH Analysis of environmental samples by Low Temperature Fluorescence Spectroscopy, and to examine the utility of Shpol'skii Spectroscopy for computer based data acquisition and processing in order to identify a selected group of PAH compounds.

PROJECT DESCRIPTION: Environmental samples will be examined after the different preparatory stages currently required for analysis. Shpol'skii Spectroscopy using a narrow spectral band laser as an excitation source will be used to identify a selected group of carcinogenic PAHs. Additionally, the suitability of Shpol'skii Spectroscopy for computer-based data acquisition and processing will be examined in order to identify a selected group of PAH compounds.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	21.9	16.7	19.6	58.2
	Work Years:	2.2	2.2	2.2	2.2

Budget Source: RAC

KEYWORDS: chemical analysis, organic compounds

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985 and 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

Solicited  
Unsolicited X

PROJECT NO: 201G  
START DATE: 07/85

SHORT TITLE: Water Quality

Dr. T.E. Unny  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): Dr. Lloyd Logan  
Water Resources Branch  
323-4984

OBJECTIVE(S): To quantify, on the basis of historical record, the uncertainties in water quality parameters in Ontario rivers and to develop a basis to assess the effect of variations of these parameters on decision-making with regard to protection against risk to the environment due to stream degradations.

- quantify existing ambient quality data
- derive probability distributions of selected parameters
- develop statistical trend approaches
- derive uncertainty trends in relation to potential water quality problems
- develop concise stochastic models to represent current loadings and effects from management generated scenarios
- test the derived models

Work Years:

Budget Source: RAC

**KEYWORDS:** water quality, statistical analysis, risk assessment

OUTPUT (papers, presentations, reports): Report, 1986; Paper presented at CCIW Workshop 1985; paper presented at Technology Transfer Conference, 1986; Paper presented at PAHS Symposium 1987.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: A Full Scale Study of the Effect of  
Wastewater Variable on the Efficacy of Ultraviolet  
Disinfection

PROJECT NO: 202C  
START DATE: 07/85

SHORT TITLE: UV Disinfection

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. G.E. Whitby  
Trojan Technologies Inc.

LIAISON OFFICER (name, location, telephone no.): G. Palmateer  
MOE (SW Region)  
(519) 661-2600

OBJECTIVE(S): To create a better understanding of the UV disinfection process at the full scale level by: a) reduction of UV transmission of effluent, b) reduction of effluent quality with primary and secondary solids, c) determination of photoreactivation and dark reactivity in situ, d) determination of efficiency of disinfection at mid-point and end-point of lamp life, e) determination of correlation between bacteriophage and E. coli; f) lamp output versus sensor response, and g) mathematical modelling versus measured parameters.

PROJECT DESCRIPTION: A full scale UV system will be subjected to a series of test situations which will provide the data for the above objectives. The test situations will include such parameters as reduced UV transmission, high suspended solids and different types of effluents. Various indicator organisms and pathogens will be enumerated before and after photoreactivation. Mathematical models will be examined.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		73.7			73.7
Work Years:		1.1			1.1

Budget Source: RAC

KEYWORDS: wastewater treatment systems, bacteriophage, E. coli

OUTPUT (papers, presentations, reports): American Soc. Microbiology (Atlanta, Georgia, 1987).; Water Pollution Control Federation Conference - Virginia, New England, Utah, Illinois, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Evaluation of Native Marsh Plant  
Species for Treatment of Domestic Sewage

PROJECT NO: 205C  
START DATE: 10/85

SHORT TITLE: Marsh Evaluation

PRINCIPAL INVESTIGATOR AND AFFILIATION:

John H. Neil, President  
Limnos Ltd.

LIAISON OFFICER (name, location, telephone no.): D. Snell

Water Resources Branch  
235-5822

OBJECTIVE(S): 1. Review of literature pertaining to the use of alternative marsh species for sewage treatment, the establishment of cells for the comparison of three native species, to develop cultural practice for scale-up and to predict the treatment capability of a fully operating system.  
2. To evaluate capacity of duckweed species for removal of ammonia from secondary effluents.

PROJECT DESCRIPTION: 1. Experimental cells will be developed and designated marsh species to be planted under controlled conditions.  
2. Implementation of monitoring program.  
3. Evaluation of the efficiency of treatment for each developed cell.  
The project will provide the Ministry with information on the efficacy of marsh treatment of domestic sewage.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	61.2				61.2
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Work Years:

Budget Source: RAC

KEYWORDS: marshland treatment, wastewater, duckweed, emergant aquatics

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Project is complete. Final report prepared.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Screening Methods for Air and Water  
Samples: Application of Inductively Coupled Plasma  
Mass Spectrometry (ICP/MS) to Elemental Analysis

PROJECT NO: 207G  
START DATE: 06/85

SHORT TITLE: Screening Methods ICP

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Drs. J.B. French (UTIAS) and  
Jon C. Van Loon (IES)  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): D. Boomer

Laboratory Services Branch  
235-5858

OBJECTIVE(S) :

- 1) To develop ICP/MS methods for multi-element analyses of solid and liquid environmental materials.
- 2) To develop ICP/MS as detector for liquid and gas chromatography columns to determine the chemical form of metals.
- 3) To extend above to include isotopic ratio studies.
- 4) To verify the developed methods.

PROJECT DESCRIPTION: An electrothermal atomizer will be developed for direct sample introduction into the ICP/Mass Spectroscopy System.

The developed methods for the analyses of gas or liquid chromatographic effluents would allow for the determination of the chemical form of toxic metals in air and water samples. The methods will further be extended to allow for the determination of isotopic ratios. The developed methods and technologies will be transferred for use in MOE laboratory.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		45.0	45.0	45.0	135.0
Work Years:					

Budget Source: RAC

**KEYWORDS:** chemical analysis, ICP/MS, screening methods

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Waste Management Planning for  
Pharmaceutical Industry

PROJECT NO: 209G  
START DATE: 11/85

SHORT TITLE: Pharmaceutical Industry

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. R.A. Stairs, E.F. Lewars  
and R. Makeja  
Department of Chemistry  
Trent University

LIAISON OFFICER (name, location, telephone no.): J. Manuel

Waste Management Branch  
323-5125

OBJECTIVE(S):

1. To assess present practice and regulations, types and quantities of pharmaceutical wastes, storage, handling and disposal.
2. To recommend changes in practice or regulations, as appropriate. To promote occupational and environmental safety and to effect economies, if possible.

PROJECT DESCRIPTION: By consultation (with industry, Ministry and OWMC personnel), by questionnaire and on-site visits, data will be collected on nature, quantities, hazards to workers or environment, of all wastes generated by pharmaceutical manufacturing. This will include process wastes as well as unwanted products. Current procedures and facilities will be assessed, and desirable changes considered in the light of current or proposed regulations.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	19.0	18.8	13.0	50.8
	Work Years:	1.9	1.9	1.2	5.0

Budget Source: RAC

KEYWORDS: waste disposal, pharmaceutical industry

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985, 1986, and 1987.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Development of Effective and Rapid                      PROJECT NO: 210G  
Clean-up Procedures for the Analysis of Dioxins/Furans                      START DATE: 06/85  
in Fish and Other Biota

SHORT TITLE: Dioxins/Furans in Fish and Biota

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. F.W. Karasek  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): R. Clement  
Laboratory Services Branch  
235-5896

OBJECTIVE(S): A new clean-up procedure consisting of two-step HPLC  
fractionation will be developed to provide fast and effective separation for  
quantitative analysis of dioxins/furans in fish extracts.

PROJECT DESCRIPTION: The two-step separation procedure previously developed  
for the determination of dioxins and furans in flyash will be modified and  
applied to the analysis of fish extracts. The new procedure will be optimized  
to allow for the determination of a large number of organic contaminants in  
each fish sample extract. When developed, the method will be validated and the  
technology will be transferred for use in MOE Laboratory.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	46.0			46.0
	Work Years:	2.0			2.0

Budget Source: RAC

KEYWORDS: clean-up, dioxins, furans, fish, biota, HPLC

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of the GC/MED System as  
Non GC/MS Screening Technique

PROJECT NO: 211C  
START DATE: 04/86

SHORT TITLE: GC/MED System

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. L. Danylewych-May  
Barringer Magenta Limited

LIAISON OFFICER (name, location, telephone no.): P. Baulu

Laboratory Services Branch  
235-5753

OBJECTIVE(S): To assess the GC/MED analytical system as a non GC/MS technique for the determination of C, Cl, Br, F, P, and S in hazardous waste and its application for the analysis of volatile and non-volatile contaminants.

PROJECT DESCRIPTION: In this phase of a broader study, the MED system will be developed and optimized to meet MOE requirements for the analysis of hazardous wastes.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	63.0			63.0
	Work Years:	1.6			1.6

Budget Source: RAC

KEYWORDS: chemical analysis, toxic waste, screening methods, GC/MED

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Monitoring Environmental Genotoxicity Using Sister Chromatid Exchanges in Mice	PROJECT NO: 212G START DATE: 07/85
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SHORT TITLE: Environmental Genotoxicity

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. M.L. Petras Department of Biology University of Windsor
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LIAISON OFFICER (name, location, telephone no.):	Dr. M. Salamone Water Resources Branch 235-5790
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OBJECTIVE(S): To continue evaluating the feasibility of using sister chromatid exchanges (SCE) in both wild and inbred (laboratory) mice as a first-line monitoring system for environmental genotoxicity. Such a system could use either animals that are already in place (natural pollution) or mice that are placed in corn-filled containers at sites to be monitored.

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PROJECT DESCRIPTION: The basic approach involves comparing SCE levels in mice that have been exposed to a particular environment with SCE levels in control mice. If a genotoxin is present in the environment being studied, the SCE level will exceed that seen in the controls. The specific objectives of this phase include:

1. The effect of a crisis situation (high genotoxic level) on SCE counts;
  2. The effects of the modes of administration of several encountered genotoxins;
  3. The duration of genotoxic effect after exposure to an agent;
  4. The variability of response in wild mice to several known mutagens;
  5. Procedures to enhance the sensitivity of the SCE technique.
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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	32.7	46.9	48.3	127.9
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Work Years:

Budget Source: RAC

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KEYWORDS: mutagenicity, pollution monitoring, sister chromatid exchanges

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OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985 and 1986.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Evaluation of Contaminant Velocity Groundwater in Low-Permeability Fractured Shale	PROJECT NO: 214G START DATE: 08/85
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SHORT TITLE: Fractured Shale

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Drs. J. Cherry and E. Sudicki Inst. for Groundwater Res. University of Waterloo
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LIAISON OFFICER (name, location, telephone no.):	C. Bostock Waste Management Branch 323-5218
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OBJECTIVE(S): To evaluate several methods for determining the average velocity of non-reactive contaminants in shale of low permeability, to assess the velocity and matrix diffusion effects in low permeability, but probably high velocity zones in the Queenston shale, and to determine how long it will take for contaminants to migrate from landfills in the Burlington-Hamilton area to Lake Ontario.

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PROJECT DESCRIPTION: The study will consist primarily of field tests at two or three locations on fractured Queenston shale in the vicinity of the Bayview Park landfill or the nearby Burlington landfill. The test sites will be instrumented with a network of cored holes, multilevel piezometers and wells. Hydraulic tests will be conducted to determine the effective bulk fracture porosity of the shale so that the Darcy equation can be used to obtain estimated values of average contaminant transport velocity under natural gradients. Borehole dilution tests will be done to determine velocity values in single boreholes. The test sites will be in zones of low permeability so that the hypothesis of high contaminant velocity in low permeability zones can be evaluated.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	33.7	33.7	22.6	90.0
	Work Years:	1.0	1.0	0.8	2.8

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Budget Source: RAC

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KEYWORDS: contaminant velocity, fractured shale, groundwater

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OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Development of Methodology for Complete Organic Compound Analysis of Complex Environmental Samples

PROJECT NO: 216G  
START DATE: 07/85

SHORT TITLE: Organic Compounds Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. F.W. Karasek  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): R. Clement  
Laboratory Services Branch  
235-5896

OBJECTIVE(S): A method will be developed for GC/MS for quantitative determination of organic compounds in complex environmental samples such as air particulate matter, landfill leachates, soils and sediments using HPLC fractionation.

PROJECT DESCRIPTION: Samples representing complex mixtures supplied by MOE will be analyzed using the developed method. The method will be optimized to provide the most comprehensive broad-spectrum identification and quantification of organic compounds. In addition, a data base of organic compounds in selected samples will be initiated for potential use for classification purposes.

When developed the technology will be transferred for use in MOE laboratory.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	25.0			25.0
	Work Years:	1.5			1.5

Budget Source: RAC

KEYWORDS: GC/MS, HPLC, fractionation, complex mixtures, organic compounds

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of Guidelines to Control the Disposal of Wastes as Backfill Material in Ontario PROJECT NO: 217C  
START DATE: 09/85

SHORT TITLE: Waste Disposal

PRINCIPAL INVESTIGATOR AND AFFILIATION: Richard J. Rush, Vice  
President & Senior Proj. Man.  
Canviro Consultants Limited

LIAISON OFFICER (name, location, telephone no.): R. Dalrymple  
Waste Management Branch  
323-5211

OBJECTIVE(S):

1. Review of guidelines related to backfill of wastes.
2. To prepare an inventory of major industrial sources of inert fill material and to describe leachate characteristics.
3. Development of a process for the classification of inert fill material.
4. Development of a preliminary set of criteria for backfill applications.

PROJECT DESCRIPTION: This study includes a survey of wastes used for backfill in Ontario and a review of current practices in Ontario and any existing guidelines of other jurisdictions in order to develop new guidelines for use by the Ministry in support of the implementation of Regulation 309.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	26.9				26.9
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Work Years:

Budget Source: RAC

KEYWORDS: waste disposal, backfill material, industrial waste

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Sewage Sludge Compost as Turf  
Fertilizer

PROJECT NO: 218G  
START DATE: 08/85

SHORT TITLE: Turf Fertilizer

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.L. Eggens  
Dept. of Horticult. Science  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): N. Ahlberg  
Waste Management Branch  
323-5189

OBJECTIVE(S): To evaluate the usefulness of sewage sludge compost as a replacement to milorganite as a fertilizer for golf course fairways as well as for other applications (home lawns, athletic fields, sod farms, etc.)

PROJECT DESCRIPTION: Laboratory and field work will be carried out to observe the influence of the compost on wear tolerance, environmental stress, disease, recuperative potential, thatch accumulation and playing quality of high maintenance heavily used turf.

Successful completion of the project will provide a commercial sewage sludge fertilizer that would replace Milorganite in the marketplace. Minor nutrient formulation amendments may be necessary.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	22.4	23.3	24.6	70.3
	Work Years:	2.0	2.0	2.0	6.0

Budget Source: RAC

KEYWORDS: natural fertilizers and composts, sewage sludge

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Dose Response for Selected Environmental Air Pollution on Selected Populations	PROJECT NO: 219G START DATE: 10/85
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SHORT TITLE: Dose Response of Air Pollution

PRINCIPAL INVESTIGATOR AND AFFILIATION: F. Silverman, R.J. Shephard and P. Corey  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): W. Chan  
Air Resources Branch  
965-4081

OBJECTIVE(S): To examine effects of ambient urban air pollution on cardiorespiratory health and exercise performance in runners by: a) Establishing if a difference exists between 1) stationary monitoring at a central downtown station, 2) stationary monitoring at the running route, and 3) mobile site monitoring to approximate personal exposure; b) Establishing if an impairment in pulmonary function and exercise performance, an increased COHb% or increase in respiratory symptoms occur due to exposure; c) Evaluating by multiple regression analysis any such changes with the level of pollutants for each of the monitoring sites; d) Relating sensitivity to pollutants as measured by the multiple regression coefficients to general health effects (sick days, symptoms, performance times in races).

PROJECT DESCRIPTION: Subjects will be selected from the Longboat Road Runners Club and followed during weekly training runs and selected races. Measurements include: pulmonary function and carboxyhaemoglobin (COHb) measured before and after running, performance, subjective evaluations, symptoms, sick days, doctor visits, hospital days and an updated version of the Cornell Medical Index will be applied. Pollutants measured will include sulphur dioxide, nitrogen dioxide, ozone, CO and inhalable particulate matter, etc. along with environmental covariates (temperature, humidity, wind velocity, etc.) for each training run. Existing central station monitoring will be supplemented by the Gage samplers (for sulphur dioxide, nitrogen dioxide and particulate matter) placed at the central station at the starting location of the running routes and carried bicycles following alongside the runners. Statistical comparisons include pollutant type (nitrogen dioxide, sulphur dioxide, etc.), pulmonary function, COHb and performance changes, and differences attributable to methods, types and locale of pollutant monitoring.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	69.0	60.0	40.0	169.0
	Work Years:				

Budget Source: RAC

KEYWORDS: air pollution, human exposure to pollutants

OUTPUT (papers, presentations, reports): Poster paper at TTC, 1987.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Mutagenicity of Complex Mixtures of Polycyclic Aromatic Hydrocarbons in Ambient Air Particulate Matters (APM)                      PROJECT NO: 220G  
START DATE: 10/85

SHORT TITLE: Mutagenicity of PAH

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. J.A. Heddle  
York University

LIAISON OFFICER (name, location, telephone no.): Dr. G. Diamond  
Air Resources Branch  
965-4081

OBJECTIVE(S): To study mutagenic and carcinogenic potential of polyaromatic hydrocarbons in ambient air particulate matter and to determine the hazard and mutagenic risk of their mixture.

PROJECT DESCRIPTION: Mixtures of PAH's will be extracted from air particulate matter and subsequently tested for mutagenic activity. The findings will be compared with those on US-NBS standard material as well as with individual PAH mutagenicity data.

The results will be used to assess the effects and mechanisms of PAH's on the enzyme system and will provide the Ministry with new knowledge in the activity, toxicity, and dose-response relationships of chemical mutagens.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	103.8	103.8		207.6
	Work Years:	3.4	3.4		6.8

Budget Source: RAC

KEYWORDS: mutagenicity, organic compounds, air pollution, polycyclic aromatic hydrocarbons, ambient air particulate matters

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985 and 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited X  
INTERNAL                      Grant                      Unsolicited

PROJECT TITLE: Application of Robotics to the  
Analysis of Trace Organics

PROJECT NO: 223C  
START DATE: 01/86

SHORT TITLE: Robotics

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Ms. Cecilia Chau  
Mann Testing Laboratories Ltd.

LIAISON OFFICER (name, location, telephone no.):

G. Crawford  
Laboratory Services Branch  
235-5757

OBJECTIVE(S): To design, test and deliver a robotics system to provide fully automated sample preparation of fish and biological tissues prior to analysis for trace organics.

PROJECT DESCRIPTION: The consultant will study MOE's current manual extraction and concentration methods for fish and will plan the hardware and software necessary to carry out the weighing, transfer, dissolution, extraction, extract isolation and steps necessary to provide a trace organics solvent extract prior to cleanup. The consultant will acquire appropriate hardware (modifying if necessary), computer controller etc. Will write and debug the necessary computer control software, will assemble and get the system on fish samples, in parallel with MOE analysis of split aliquots. Acceptance will be based on comparative performance of manual and robotic system.

The consultant will deliver and set up the system at MOE labs and will ensure it to be operational and train MOE staff in its operation.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	170.0				170.0
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Work Years:

Budget Source: RAC

KEYWORDS: robotics, automation, fish and biological tissue, preparation, trace organics analysis

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited X
INTERNAL	Grant	Unsolicited

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PROJECT TITLE: Development and Validation of a Methodology for Assessing the Relative Environmental Hazards of Chemical Contaminants	PROJECT NO: 226C START DATE: 08/85
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SHORT TITLE: Screening Methods

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Cantox Inc.

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LIAISON OFFICER (name, location, telephone no.): J. Smith  
Hazardous Contaminants Branch  
323-5113

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OBJECTIVE(S):

- to provide an operational, peer-reviewed risk identification methodology for standard setting
  - to provide assessment criteria to evaluate the hazards of chemicals selected by HCCB, ARB, WMB, WRB and Regions
  - to define the information gathering process for assessing the hazards of individual chemicals
- 

PROJECT DESCRIPTION: This project represents the cornerstone of MOE's multi-media standard setting process. A tiered screening system for the identification and assessment of chemicals will be developed. Those chemicals of greatest concern will be screened at successive stages using more detailed information sources and more comprehensive criteria. Substances would be evaluated in terms of both their effects and exposure potential in Ontario. The magnitude of the exposure and the degree of the effects will be used to determine a concern level - high, medium, or low. The adequacy of the information upon which the concern is based will be used in establishing a confidence level - high, medium or low. Together, the parameters of concern and confidence will determine the relative priority for standard setting or other environmental management action based on the hazard of the substance. Thirty-two selected substances will be used to validate the methodology.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	100.0	100.0		200.0
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Work Years:

Budget Source: RAC

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KEYWORDS: pollutant effects, environmental risk assessment, chemical contaminants

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: The Feasibility of Biomass Removal  
in Shallow Impoundments as a Means of Reducing  
Nutrient Loading

PROJECT NO: 229C  
START DATE: 11/85

SHORT TITLE: Biomass Removal

PRINCIPAL INVESTIGATOR AND AFFILIATION:

K. Clarke-Whistler, J.  
Fitchko (Beak) & G. Gesparady  
(CVCA)  
Beak Consultant Ltd. &  
Credit Valley Cons. Auth.

LIAISON OFFICER (name, location, telephone no.): K. Nicholls  
Water Resources Branch  
235-5810

OBJECTIVE(S):

1. To determine the potential of biomass harvesting as a means of reducing nutrient loading from the Orangeville Reservoir to the Upper Credit River.
2. To identify nutrient input/output sources on a seasonal basis.

PROJECT DESCRIPTION: Nutrient inputs/outputs to and from the Orangeville Reservoir will be monitored for a full hydrological cycle. The nutrient load contained within vegetation and the water column of the reservoir will be determined on a seasonal basis. The percent of the total nutrient load removed via biomass harvesting will be determined, and a site-specific nutrient budget developed.

Anticipated Results: Aquatic vegetation is a major sources of nutrients to downstream receiving systems, and biomass removal may prove to be an effective means of controlling nutrient loadings.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	26.0			26.0
	Work Years:	0.3			0.3

Budget Source: RAC

KEYWORDS: biomass, vegetation, water quality, nutrient loading

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Development of an Ultrasonic Nebulizer for Stable and Reproductive Production of Aerosols for Atomic Spectrometric Analysis	PROJECT NO: 230G START DATE: 10/85
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SHORT TITLE: Ultrasonic Nebulizations

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. J.C. Van Loon Inst. of Environ. Studies University of Toronto
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LIAISON OFFICER (name, location, telephone no.):	D. Boomer Laboratory Services Branch 235-5858
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OBJECTIVE(S):

- To develop an inexpensive but reliable ultrasonic nebulizer system.
- To evaluate this device using AAS, ICP/AES and ICP/MS\*.

\* AAS-Atomic Absorption Spectrometry, ICP/MS-Inductively Coupled Plasma/Mass Spectrometry, ICP/AES-Inductively Coupled Plasma Atomic Emission Spectrometry

PROJECT DESCRIPTION: A transducer/power supply system from a domestic ultrasonic humidifier has been used. The power supply has been modified for stability and proper impedance matching. Use of a coating directly on the transducer plate surface (compared to a bonded plate) is being investigated.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	14.2	16.8		31.0
	Work Years:				1.1

Budget Source: RAC

KEYWORDS: chemical analysis, atomic absorption, ultrasonic nebulization

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986. The report was used to fulfill the requirements for an M.Sc.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: The final report has been received. The Report Approval Form is expected shortly from the Liaison Officer.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Development of a Standard Clam  
Biomonitoring Methodology for the Detection of  
Trace Contaminants Within Waters of the Ontario  
Great Lakes Region

PROJECT NO: 231C  
START DATE: 05/86

SHORT TITLE: Clam Biomonitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION: A. Melkic, President  
Integrated Explorations

LIAISON OFFICER (name, location, telephone no.): A. Hayton  
Water Resources Branch  
235-5800

OBJECTIVE(S): 1. Assess the adequacy of supplies of uncontaminated clams.  
2. Seek sources of alternative species from varied environments.

PROJECT DESCRIPTION: 1. Evaluate standing stocks in Balsam Lake.  
2. Explore other lakes for additional sources of various clam species.  
Anticipated Results:  
1. Standing stock, size distribution and spatial extent of presently used  
clam bed.  
2. Location of other clam beds within Balsam Lake.  
3. New sources of class outside of Balsam Lake.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	51.5				51.5
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Work Years:

Budget Source: RAC

KEYWORDS: biomonitoring, clams, invertebrates, trace contaminants, water  
quality

OUTPUT (papers, presentations, reports): Paper presented at Technology  
Transfer Conference, 1986

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Municipal Solid Waste-Feasibility  
of Gasification with Plasma ARC

PROJECT NO: 234C  
START DATE: 03/86

SHORT TITLE: Gasification with Plasma ARC

PRINCIPAL INVESTIGATOR AND AFFILIATION:

A. Tsangaris & G. Carter  
Resorption Canada Ltd.

LIAISON OFFICER (name, location, telephone no.): R. Foggett

Waste Management Branch  
323-5145

OBJECTIVE(S): To demonstrate the operational and environmental benefits of plasma arc gasification of municipal solid waste (MSW) and its potential acceptability in Waste Management.

PROJECT DESCRIPTION: Resorption Canada Limited (RCL), OBOE Engineering Ltd and Ontario Hydro propose a feasibility study to conduct experimentation with MSW within the RCL plasma arc research facility to demonstrate the salient operational and environmental characteristics of such a process. The existing RCL plasma research facility is presently capable of gasification of MSW, however, it would require the optimization of some of its equipment plus the addition of some other equipment in order to permit the total operation results which would be required. The work schedule has been organized into two stages, stage 1 to determine the Higher Heating Value (HHV) of the product gas and the total process heat balance, and Stage 2 to determine the environmental acceptability of the process and the subsequent combustion of the product gas. Organization in this manner permits a decision point at the end of stage 1 to permit the assessment of the heat balance results obtained prior to the commencement of Stage 2. The expected duration of the project is 59 weeks.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		25.0	25.0		75.0
Work Years:		1.2	0.5		1.7

Budget Source: RAC

KEYWORDS: solid wastes, municipal waste, gasification, plasma ARC

OUTPUT (papers, presentations, reports): Paper presented at the Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Ontario Hydro

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: The Use of Various Bacterial Short-Term Tests to Screen Industrial Effluents for Mutagenic Activity	PROJECT NO: 237G START DATE: 03/86
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SHORT TITLE: Bacterial Short-Term Test

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. D. Logan York University
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LIAISON OFFICER (name, location, telephone no.):	D. Rokosh Water Resources Branch 235-5787
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OBJECTIVE(S): To evaluate the suitability of the Fluctuation Assay for mutagenicity testing for various industrial sectors, to screen industrial aqueous effluents for mutagenic activity and to set the priority for such effluents, based on their mutagenic activity, for additional genotoxicity testing.

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PROJECT DESCRIPTION: Industrial effluent samples, to a maximum number of 30 from a variety of industrial sectors, including pulp and paper, mining and petrochemical, will be provided for testing by the Ministry of the Environment. These effluents will be screened for mutagenic activity, utilizing the Ames Plate Incorporation Assay and the Fluctuation Assay (reportedly more sensitive to mutagenic compounds than the plate incorporation assay). Effluents will be pH adjusted (if necessary) and sterilized (using pressure filtration) but their chemical concentration will not be altered. On completion of the testing a report will be prepared containing a summary of screening data and a ranking of samples based on their mutagenic activity. An attempt will be made to relate this activity with historical chemical analysis of effluents from specific industries.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	12.0				12.0
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Work Years:

Budget Source: RAC

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KEYWORDS: mutagenicity, bacteriology, industrial effluents

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: The Use of Aquatic Vegetation and Invertebrates to Monitor Chlorinated Hydrocarbons In The Lake Huron - Lake Erie Corridor	PROJECT NO: 241G START DATE: 03/86
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SHORT TITLE: Aquatic Vegetation/Invertebrates

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. P. Hebert The Great Lakes Institute University of Windsor
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LIAISON OFFICER (name, location, telephone no.):	W. Scheider Water Resources Branch 323-4925
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OBJECTIVE(S): The proposed research has three objectives: (1) to use aquatic vegetation and mussels suspended in the water column to examine the vertical distribution of toxic chemicals, (2) to carry out laboratory experiments to calibrate uptake rates (ie. the relationship between body burden and water concentration) to provide a basis for interpreting the field data, and (3) to assess the concentration of toxic chemicals in major components of the Lake St. Clair biota.

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PROJECT DESCRIPTION: Laboratory and field studies will be carried out to examine the factors affecting contaminant uptake by aquatic vegetation and mussels. Contaminant concentration in the major biotic compartments of Lake St. Clair will be determined. Existing models used for predicting the fate of toxic chemicals will be modified and applied to the St. Clair River and to Lake St. Clair.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	50.0			250.0
	Work Years:				

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Budget Source: RAC

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KEYWORDS: toxic chemicals, uptake rates, aquatic vegetation mussels, vertical distribution, existing concentrations

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OUTPUT (papers, presentations, reports): Technology Transfer Conference 1987, Semi-annual Progress Reports since 1986, papers presented at IAGLR 1987, 1988.

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EXTERNAL PARTICIPATION (ministries, governments, agencies): The Great Lakes Institute

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COMMENTS: Grant cheque for \$250,000 was sent to University of Windsor in May, 1986. Funds to be released to Dr. Hebert annually pending satisfactory progress reports.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Toxicity of Pentachlorophenol to  
Zooplankton: Fate and Effects

PROJECT NO: 242G  
START DATE: 05/86

SHORT TITLE: Pentachlorophenol

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. N.K. Kaushik  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Luek Wong

Water Resources Branch  
235-5813

OBJECTIVE(S): The current proposal will examine: (a) Bioconcentration and bioaccumulation of PCPs in Zooplankton using <sup>14</sup>C-labelled PCP; (b) Interaction of pH with PCP toxicity and bioavailability; (c) Effect of temperature on PCP toxicity (d) Toxicity tests then may be carried out under field conditions using limnocorrals.

PROJECT DESCRIPTION: Factors affecting the toxicity of PCP such as the age and/or size of the test organisms, pH, temperature, hardness, and exposure duration on the acute and chronic toxicity of both formulations of PCP to the two species of daphnids will be investigated.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	15.1				15.1
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Work Years:

Budget Source: RAC

KEYWORDS: toxicity, pentachlorophenol, zooplankton

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Demonstration of the Phoredox Process  
at Lakeview WPCP

PROJECT NO: 243G  
START DATE: 05/86

SHORT TITLE: Phoredox Process

PRINCIPAL INVESTIGATOR AND AFFILIATION:

George G. Powell, P. Eng.  
Gore & Storrie Limited

LIAISON OFFICER (name, location, telephone no.): K. Brown

South Peel Water Supply System  
274-6710

OBJECTIVE(S): To evaluate the effect of the introduction of the Phoredox process on overall plant performance.

PROJECT DESCRIPTION: The anaerobic zone in the Phoredox process has the potential to reduce aeration requirements, improve BOD removal, solids settling and sludge handling. Biological removal of phosphorus is also possible. One unit of the Lakeview WPCP will be converted to operate in this mode.

Anticipated Results:

1. Substitution of mixing for aeration results in less power usage.
2. Removal of chemical for phosphorus removal results in reduced operational costs.
3. Improved BOD removal results in potential for retrofitting for fine bubble aeration. This should also reduce operation costs.
4. Improved and lesser solids handling should be experienced.
5. Improved settling results in a better effluent quality.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	25.0			25.0
	Work Years:	0.2			0.2

Budget Source: RAC

KEYWORDS: Phoredox process, sewage treatment

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Reproductive Outcomes in Southwestern Ontario      PROJECT NO: 245G  
START DATE: 07/86

SHORT TITLE: Reproductive Outcomes

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. J. Robertson  
Dept. of Epidemiology & Bio-  
statistics  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): L.F. Smith  
Ministry of Health  
963-2238  
A. Vajdic  
Water Resources Branch  
323-4873

OBJECTIVE(S): To carry out an epidemiological study of potential health effects caused by chemical spills and potential contamination of drinking water in the Lambton and Kent counties.

PROJECT DESCRIPTION: The level of effects on reproductive outcomes and risk caused by the threat posed by the St. Clair River chemical contamination will be documented retrospectively.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	65.0			65.0
	Work Years:	6.3			6.3

Budget Source: RAC

KEYWORDS: epidemiology, drinking water contamination

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Funded jointly with the Ministry of Health (\$65,000).

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Study of the Thermal Reactions of Polychlorinated Dibenzo-p-Dioxins on Flyash Particles Under Incinerator Conditions PROJECT NO: 246G START DATE: 04/86

SHORT TITLE: Dioxins/Flyash

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. F.W. Karasek  
Professor of Chemistry  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): R. Clement  
Laboratory Services Branch  
235-5890

OBJECTIVE(S): Incinerator flyash will be placed in a heated flowtube. Nitrogen will be passed through the flyash to an impinger/florisil combination which will absorb any organic compounds volatilized from the flyash. Some suspected precursors of chlorinated dioxins and dibenzofurans will be introduced into the gas stream above the flyash. The flyash, flowtube, impinger and florisil will be analysed for dioxins and furans after each experiment. The temperature range of 100°C to 600°C will be investigated.

PROJECT DESCRIPTION:

1. Establish the thermal behaviour of chlorinated dioxins and dibenzofurans on flyash particles under incinerator conditions.
2. Identify precursors and establish mechanisms of dioxin formation on flyash particles.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	30.0			30.0
	Work Years:	0.5			0.5

Budget Source: RAC

KEYWORDS: incinerator flyash, dioxins, furans, thermal reactions

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Sample Introduction and Laser  
Excitation

PROJECT NO: 247G  
START DATE: 03/86

SHORT TITLE: Sample Introduction

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. E.D. Salin  
McGill University

LIAISON OFFICER (name, location, telephone no.): D. Boomer

Laboratory Services Branch  
235-5858

OBJECTIVE(S):

1. The development of a microsample liquid introduction system for inductively coupled plasma mass spectrometry (ICP-MS).
2. The completion of the development and evaluation of a microsample liquid sample introduction system for inductively coupled plasma atomic emission spectrometry (ICP-AES).

PROJECT DESCRIPTION: A new computer controlled wire loop direct sample insertion device (DSID) should be installed on the MOE ICP-MS spectrometer, preferably with an autosampler. The same sample introduction system will be evaluated extensively for ICP-AES for trace element determinations. Detection Limits, linearity and dynamic range will be determined for the elements of interest at trace levels in water samples.

MOE has a number of ICP-AES systems which could use the wire loop technique to gain detection limit improvements by 10 to 100 with the wire loop DSID. This will improve MOE performance and eliminate some sample concentration steps, enhancing sample throughput and minimizing contamination.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	31.1			31.1
	Work Years:	1.0			1.0

Budget Source: RAC

KEYWORDS: ICP-MS, ICP-AES, laser excitation, sample introduction

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Metal Uptake by Cladophora Glomerata  
in Niagara River

PROJECT NO: 248G  
START DATE: 04/86

SHORT TITLE: Metal Uptake/Cladophora

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Pamela Stokes  
Inst. for Environ. Studies  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): M. Jackson

Water Resources Branch  
235-5812

OBJECTIVE(S):

1. To determine the rate of uptake and loss of selected heavy metals in Cladophora Glomerata in the Niagara River.
2. To determine the seasonal variation in selected heavy metals in Cladophora Glomerata in the Niagara River.

PROJECT DESCRIPTION: Rates of uptake and loss of heavy metals in Cladophora will be determined by transfer experiments among sites along the river. Water and algal samples will be taken on a weekly basis throughout the summer; in order to determine seasonal variation in metal levels.

The rate of uptake will be rapid (hours) and the loss rate will be slow. This would lend support to the MOE programme for the use of Cladophora as a biomonitor.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	7.0				7.0
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Work Years:

Budget Source: RAC

KEYWORDS: biomonitoring, metals uptake, Cladophora Glomerata

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Township of Ignace Groundwater Quality Identification      PROJECT NO: 252G  
START DATE:

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SHORT TITLE: Groundwater Quality

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PRINCIPAL INVESTIGATOR AND AFFILIATION: D.R. Turnbull, P. Eng.  
International Water Supply

LIAISON OFFICER (name, location, telephone no.): M. Toza  
EALUP  
323-4475

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OBJECTIVE(S): Determine the feasibility of the Vyredox In-ground Biological Treatment for removing iron, manganese, and hydrogen sulphide from groundwater before reaching the production wells at Ignace in Northern Ontario.

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PROJECT DESCRIPTION: A pilot plant study will be undertaken incorporating the Vyredox process which establishes a biological treatment zone in the aquifer to remove iron, manganese, and hydrogen sulphide.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	45.6			45.6
	Work Years:				

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Budget Source: RAC

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KEYWORDS: Vyredox In-Ground Biological Treatment, groundwater, Ignace

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Study of the Spatial Distribution of the Impact of Sudbury Smelting Emissions	PROJECT NO: 254G START DATE: 04/86
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SHORT TITLE: Sudbury Emissions

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. E.A. McBean Dept. of Civil Engineering University of Waterloo
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LIAISON OFFICER (name, location, telephone no.):	N. Reid Air Resources Branch 965-1634
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OBJECTIVE(S):

1. To study the spatial distribution of the impact of emissions from the Sudbury mining smelters;
2. To study the impact of the variability of meteorologic conditions on seasonal and annual deposition patterns with a view to obtaining estimates of necessary length of monitoring records to attain stable statistics;
3. To study the impacts of spatial intensity of monitoring networks to define deposition patterns; and
4. To encompass the assessment information by contouring statistics and thereby provide areal deposition patterns, as opposed to point-specific receptor information.

PROJECT DESCRIPTION: To study, using a combination of statistical analyses and computer assessments, the spatial intensity of the APIOS monitoring network, in regard to Sudbury emissions.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	10.9			10.9
	Work Years:	0.4			0.4

Budget Source: RAC

KEYWORDS: smelting emissions, Sudbury, deposition patterns

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

Solicited  
Unsolicited X

PROJECT NO: 255C  
START DATE: 04/86

SHORT TITLE: Coke Oven Emissions (Phase II)

Dr. G.H. Thomas,  
Environmental Chemical  
Engineering Division  
Ontario Research Foundation

LIAISON OFFICER (name, location, telephone no.): Dr. G. Diamond  
Air Resources Branch  
965-4081

OBJECTIVE(S): To utilize collected coke oven emissions samples from 3 steel mills in Ontario to better define the chemical nature of COE (fractionation - Compound Identification - Compound Quantification). To relate the findings to the mutagenicity of the various fractions in biological assay studies for comparison with the mutagenicity of nonfractionated material.

PROJECT DESCRIPTION: Phase I of the project has been successfully completed. In phase II, short-term biological tests will be coupled with chemical analysis of complex PAH mixtures for use in environmental health assessment. Various PAH compounds will be identified in emissions samples collected both up-wind and down-wind in the vicinity of steel mills.

Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	109.4	109.4
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Work Years:

Budget Source: RAC

KEYWORDS: coke ovens, emissions, organic solvent extractables, PAH's, mutagenicity

OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1985

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Sediment Transport Study

PROJECT NO: 256C  
START DATE: 06/86

SHORT TITLE: Sediment Transport

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Mr. R.F. Holloran  
Beak Consultants Ltd.

LIAISON OFFICER (name, location, telephone no.): B. Kohli

Water Resources Branch  
323-4961

OBJECTIVE(S): To predict longshore and across-shore suspended and bedload transport rates for varying sediment particle sizes under a range of known environmental conditions (spatial and temporal varying current, waves and bathymetry). This will permit assessment of the short-term and long-term fates of contaminated sediment particles from sources such as rivers, STP and lakefilling.

PROJECT DESCRIPTION: To conduct a thorough literature search, select a suitable model that can achieve the objectives of study. To design and conduct a 2-month preliminary field program and collect data for model input. An interactive computer model for IBM PC to be installed on Great Lakes computer facilities. The use of this model will enhance our capabilities in assessing fates of contaminated sediments and complement the ongoing investigations into the suspended sediment inputs and in-place pollutants.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	97.7				97.7
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Work Years:

Budget Source: RAC

KEYWORDS: contaminated sediment, bedload, suspended, transport, prediction, fate assessment

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: The project has been delayed due to lake storms during the experiment. Expected completion date is March, 1989.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant	Unsolicited X

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PROJECT TITLE: Retractable Composite Absorbents for Environmental Clean-up	PROJECT NO: 257C START DATE: 04/86
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SHORT TITLE: Retractable Absorbent

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. A.E. Redpath, President  
Ecoplastics Limited

LIAISON OFFICER (name, location, telephone no.): O. Meresz  
Laboratory Services Branch  
235-5762

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OBJECTIVE(S): The clean up of chemically contaminated creek, river bed and lake bottom sediments is a problem of increasing importance. This 3-month study proposes to investigate the combination of two novel technologies: magnetically retractable absorbents with polymer matrix support systems. It is intended to be a feasibility study that: a) fully defines the practical requirements of polymer based retractable absorbent system, b) demonstrates in the laboratory the technical feasibility of the process and c) using examples from b), provides the basis for a patent application.

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PROJECT DESCRIPTION: The project will have three basic tasks, consistent with the objectives given above. Firstly, a literature review and technological survey will be made to define suitable materials and methods from which magnetically retractable polymeric absorbents can be manufactured. In consultation with MOE personnel the best means of field application of the technology will be defined. Secondly, test retractable absorbents will be prepared (based on the information from the first task) and tested in the laboratory. The final task will be a patent search and new patent preparation using the results of the first two tasks.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	29.6			29.6
	Work Years:	0.3			0.3

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Budget Source: RAC

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KEYWORDS: retractable absorbent, polymer matrix support, environmental clean-up

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: A patent has been applied for by MOE.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Sound Levels at a Distance From  
Industrial Plants

PROJECT NO: 258C  
START DATE: 02/87

SHORT TITLE: Sound Level

PRINCIPAL INVESTIGATOR AND AFFILIATION:

T. Kelsall and D.A. Ogilvie  
Hatch Associates

LIAISON OFFICER (name, location, telephone no.): L. Kende

Approvals Branch  
440-3588

OBJECTIVE(S):

1. To validate the prediction methodology used in C.S.A. standard Z107.55;
2. Encourage the prediction's use and help standardize the format of noise impact assessments by computerizing it, allowing wide distribution.

PROJECT DESCRIPTION: The prediction would be validated in two ways;

1. The results of similar predictions would be compared with sound levels of completed installations.
2. Certain aspects of the prediction would be field tested.

A user-friendly computer implementation of the prediction on popular computers would be prepared.

The computer implementation is expected to be widely distributed by MOE, HAL or CSA. This should result in its increased use in preparing noise impact assessments. Standardizing the methods used in these assessments will improve their quality and speed their review.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	28.5				28.5
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Work Years:

Budget Source: RAC

KEYWORDS: noise pollution, noise impact assessment

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Application of the Fugacity Model to Predicting the Behaviour of Arsenic in the Environment	PROJECT NO: 259G START DATE: 05/86
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SHORT TITLE: Fugacity-Arsenic

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. D. Mackay and M.L. Diamond Institute for Environmental Studies, U. of T.
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LIAISON OFFICER (name, location, telephone no.):	Deo Persaud Water Resources Branch 323-4926
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OBJECTIVE(S): Is to develop a model (suitable for use by Ministry staff) which can be used to predict the dynamics and fate of inorganic substances in aquatic systems. The model will be initially applied to predict the behaviour of arsenic in the Moira River system in Eastern Ontario to track its recovery from decreasing primary inputs of arsenic. The model will incorporate inputs of arsenic from contaminated sediments, and as such, will quantify the flux of arsenic at the sediment/water interface. Results from this model will be applicable to additional metals in other geographic areas.

PROJECT DESCRIPTION: A preliminary model will be developed based on the information obtained from the literature. The results obtained from this model will be used to orient the direction of further research. It is anticipated that at least some laboratory and field measurements will be necessary to quantify the arsenic species present in the systems and the flux of arsenic at sediment water interface. These measurements will then be used to improve the reliability and accuracy of the model. The results obtained from this study can be used on two levels. First, the results will provide insight into the dynamics and fate of arsenic in the Moira River. The model can be used to document the success of remedial abatement measures undertaken at Deloro and to provide an estimate on the time required for recovery of the system. As well, the model may be used to test any additional abatement measures that may be proposed. Secondly, the model will serve as the basis for extension to arsenic in other aquatic systems, and additional elements in other geographic locations.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	22.5			40.9
	Work Years:				

Budget Source: RAC

KEYWORDS: equivalent model, arsenic, sediment, in-place pollutant

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Accumulation and Pathways of Mercury  
in Benthic Invertebrates

PROJECT NO: 260G  
START DATE: 04/86

SHORT TITLE: Accumulation of Mercury

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Pamela Stokes  
Inst. for Environ. Studies  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): G. Mierle

Water Resources Branch  
Dorset Research Centre  
(705) 766-2412

OBJECTIVE(S): The overall objective of the study is aimed at a better understanding of the fate of mercury in invertebrates, in order to fill the missing link between fish mercury and sediment mercury contents. A better understanding of mercury in remote aquatic ecosystems should be achieved.

PROJECT DESCRIPTION: The study is divided in two parts. Field work will be done in the first year on three lakes (Lake Vernon, Mary and Fairy Lakes) where the fish mercury is high, and on one control lake. Quantitative data will be obtained on the benthic community. Mercury analysis will be done on bulk samples, and on abundant organisms. In the second year, the pathways of mercury will be studied in a microcosm in the lab. Mercury will be monitored in the sediments, water, organisms at different times during the experiment.

The project will evaluate the potential contribution of benthic invertebrates to fish mercury. Specie(s) or group of species that are good bioaccumulator of mercury shall be identified. Mercury concentrations in invertebrates should vary between sites on the same lake. Finally the importance of benthic invertebrates in mercury cycling in the environment will be determined.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	30.2	14.8		45.0
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Work Years:	1.5	0.6		2.1
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Budget Source: RAC

KEYWORDS: mercury, bioaccumulation, fish, sediment, benthic invertebrates

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Dispersion of the Stouffville Contaminant Plume	PROJECT NO: 261G START DATE: 04/86
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SHORT TITLE: Stouffville

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	R.N. Farvolden & E.O. Frind Inst. for Groundwater Res. University of Waterloo
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LIAISON OFFICER (name, location, telephone no.):	A. Mellary Central Region 424-3000
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OBJECTIVE(S):

1. To determine the hydrogeologic factors at the Stouffville site that are important in the development and dispersion of contaminant plumes that have been identified in previous work;
  2. To describe the contaminant plumes, and their history;
  3. To predict future development or dispersion of the plume(s). We plan to utilize, in a modest way, all modern techniques at our disposal to address this problem.
- 

PROJECT DESCRIPTION: The study has used other parameters in addition to Chloride to determine their migrational behaviour. Transport modelling techniques were applied to simulate the migration and dispersion of the contaminant plume. Further work is planned to include the installation of four new multilevel piezometers to increase the validity of the mathematical models. Comparison of reactive compounds migration with the conservative case will provide information on attenuation characteristics of the aquifer.

Anticipated Results:

The results will provide a better understanding of the mechanisms which influence plume development in this major aquifer and an indication of what can be expected in the future.

Also, we should learn what parameters and hydrogeological factors are most useful in understanding plume migration.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	25.4	17.5		42.9
	Work Years:	0.8	0.5		1.3

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Budget Source: RAC

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KEYWORDS: Stouffville, contaminant plume, transport modelling

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OUTPUT (papers, presentations, reports): Paper presented at Technology Transfer Conference, 1986.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Treatment of Municipal Sewage Lagoon      PROJECT NO: 262G  
Effluent by Means of Rapid Infiltration at Markdale      START DATE: 04/86

SHORT TITLE: Lagoon Effluent Treatment

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Mr. E. Foy  
   Village of Markdale

LIAISON OFFICER (name, location, telephone no.): B. Novakovic  
   MOE Southwestern Region  
   (519) 661-2200

OBJECTIVE(S):

1. To achieve maximum treatment of municipal sewage lagoon effluent.
2. To obtain information on sewage effluent movement and role of microbiological processes.
3. To develop criteria for optimum operation of rapid infiltration systems for the protection of water quality in the Rocky Saugeen River.

PROJECT DESCRIPTION: Variable hydraulic loading of infiltration basins will be used to develop an appropriate loading cycle.

This will result in: a) Optional utilization of each basin, b) provide maximum treatment of infiltrated municipal sewage lagoon effluent, and c) protection of surface water.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	25.0			25.0
	Work Years:	1.1			1.1

Budget Source: RAC

KEYWORDS: municipal sewage treatment, lagoon effluent, rapid infiltration, Markdale

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: The Influence of Dissolved Organic Matter in the Cycling of Hydrophobic Organic Pollutants in South-Central Ontario Lakes	PROJECT NO: 263G START DATE: 03/86
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SHORT TITLE: Dissolved Organic Matter/S.C. Ont. Lakes

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Harold Harvey  
Dept. of Zoology  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): C. Schenk  
Water Resources Branch  
323-4918

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OBJECTIVE(S):

1. To determine the association between natural dissolved organic material (DOM) and organic contaminants.
  2. To examine influence of DOM on bioavailability of the contaminants.
- 

PROJECT DESCRIPTION:

1. Lake water filtered through 0.3  $\mu$ m filters will be spiked with  $^{14}$ C labelled compound. Distilled water will be placed in dialysis tubing suspended in the lake water. Equilibration will be allowed for 2-4 days and activity determined.
  2. Uptake by daphnia using the same design but with water that has been filtered or UV irradiated to destroy the DOM.
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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	14.365				14.365
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Work Years:

Budget Source: WRB

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KEYWORDS: dissolved organic matter, hydrophobic organic pollutants, cycling

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: A Study of High Temperature  
Photochemical Kinetics of Sulphur Dioxide and  
Nitrogen Oxides for a Flue Gas Treatment Process

PROJECT NO: 268C  
START DATE: 09/86

SHORT TITLE: Flue Gas Treatment

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Robert C. Caton  
Vice President and Director  
Concord Scientific Corp.

LIAISON OFFICER (name, location, telephone no.):

Ken Smith  
Air Resources Branch  
965-5776

OBJECTIVE(S): 1. To measure the rates and quantum yields (photon efficiencies) for the UV photochemical oxidation of sulphur dioxide and nitrogen oxides in gas mixtures simulating the composition and operating temperature of coal-fired thermal power plant flue gases.  
2. To assess the feasibility of the process for larger-scale applications, taking into account lamp characteristics for available equipment and projected costs.  
3. To verify the predictive capability of computerized model of the oxidation process so that it may be used to optimize conditions for design of a pilot plant.

PROJECT DESCRIPTION: An eight-month laboratory study will be conducted to measure the removal rate and efficiencies of SO<sub>2</sub> and NO<sub>x</sub> in a variety of synthetic gas mixtures at 200-250°C under short-wavelength (less 200nm) irradiation. The results of a computerized photochemical kinetics model will be compared with the experimental results to confirm the validity of the model.

The results will be used to assess design requirements for adaptation of the process and possibly for design of a pilot plant to test more realistic application of the UV process.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	78.8	148.7		227.5
	Work Years:				

Budget Source: RAC

KEYWORDS: photon efficiencies, UV process, photochemical kinetics

OUTPUT (papers, presentations, reports): Final report due by December 31/87.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Factors Influencing Trace Metal Levels in Zooplankton in Ontario Lakes  
PROJECT NO: 269G  
START DATE: 10/86

SHORT TITLE: Zooplankton Metals

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. G.L. Mackie  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): W. Keller  
Northeastern Region  
(705) 675-4501

OBJECTIVE(S): To determine if the concentrations in zooplankton of a variety of metals may be predicted from proximity to a known source, the pH, Ca or organic carbon levels of the lakewaters, the Ca content of the plankton and/or the composition of the zooplankton communities.

PROJECT DESCRIPTION: Zooplankton samples will be collected. Information on the size, identity and feeding guild of each enumerated animal will be computer-logged. Samples for metal analysis will be processed by Inductively Coupled Plasma Emission Spectroscopy.

Benefits:

Help predict the concentrations of trace metals in zooplankton at a distance from a known large point source of metal emissions by using the pH, Ca, or organic carbon level of lakewater.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	30.0			30.0
	Work Years:	1.1			1.1

Budget Source: RAC

KEYWORDS: trace metals, zooplankton, Ontario lakes

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant X                      Unsolicited X

PROJECT TITLE: Development and Evaluation of                      PROJECT NO: 270G  
Methods and Instrumentation for the Direct Analysis                      START DATE: 09/86  
of Solids by Inductively Coupled Plasma Atomic  
Emissions Spectrometry

SHORT TITLE: Plasma Atomic Emission

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. Eric Salin  
Department of Chemistry  
McGill University

LIAISON OFFICER (name, location, telephone no.): D. Boomer  
Laboratory Services Branch  
235-5858

OBJECTIVE(S): The development of instrumentation and methodologies which will  
allow the direct analysis of solid and difficult liquid samples.

PROJECT DESCRIPTION: Inductively coupled plasma atomic emission optical  
detection methods will be used for multielemental analysis. Furnace and  
direct sample insertion methods will be evaluated.

Benefits:

1. Increased sample throughput;
2. Cost reduction;
3. Reduced matrix effects with an improvement in accuracy and detection  
limits;
4. Speed processing of complex environmental samples;
5. Rapid analysis of new sample types;
6. Transfer of developed technology to MOE laboratory.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	40.2	41.8	3.3	125.3
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Work Years:

Budget Source: RAC

KEYWORDS: elemental analysis, ICP, solids, multielement

OUTPUT (papers, presentations, reports): Paper presented at Technology  
Transfer Conference, 1986.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

EXTERNAL	X	Contract		Solicited	
INTERNAL		Grant	X	Unsolicited	X

SHORT TITLE: Longe Range Aerosols

LIAISON OFFICER (name, location, telephone no.): N. Reid  
Air Resources Branch  
965-1634

PROJECT DESCRIPTION: Several techniques in neutron activation including thermal, epithermal and prompt-gamma analysis will be developed specifically to identify metal content in aerosols.

Budget Source: RAC

OUTPUT (papers, presentations, reports):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Characterization of the Fecal  
Indicator Bacterial Flora of Sanitary Sewage with  
Application to Identifying the Presence of Sanitary  
Waste in Storm Sewers

PROJECT NO: 274G  
START DATE: 09/86

SHORT TITLE: Sewage Bacteria

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. P. Seyfried  
Dept. of Microbiology  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): M. Young

Laboratory Services Branch  
235-5866

OBJECTIVE(S):

1. To determine the concentrations of fecal indicator bacteria in storm water and storm sewers at selected Toronto locations;
2. To identify the species present in the above bacterial population;
3. To conduct the above analysis on sanitary sewers serving the same areas;
4. To develop a method to determine the presence of sanitary waste in storm sewers;
5. To apply the above procedure to the tracing of illegal sanitary connections to priority storm sewers in the Metro Toronto Area.

PROJECT DESCRIPTION: Samples will be collected from selected sites and analyzed for various types of fecal bacteria. The wastewater is then characterized by the identification of the bacteria to the species level with further serotyping and genotyping of selected groups.

The obtained information will improve Ministry ability to identify the presence of human fecal waste in intermediate sample types such as storm sewers, and would assist in making corrective measures.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	96.5	80.3		176.8
	Work Years:	3.9	3.3		7.2

Budget Source: RAC

KEYWORDS: fecal indicator bacteria, sewers, identification, characterization

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: An Ecosystem Approach to the Monitoring of Organic Aquatic Contaminants in the Muskoka - Haliburton Region	PROJECT NO: 275G START DATE: 09/86
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SHORT TITLE: Organics in Muskoka-Haliburton

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. C.D. Metcalfe ERS Program/Biology Trent University
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LIAISON OFFICER (name, location, telephone no.):	J. Ralston Water Resources Branch 323-4924
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OBJECTIVE(S): To investigate the sources and fate of persistent organic contaminants in lakes within the Muskoka/Haliburton/Renfrew area, and to assess whether these compounds are a long-term environmental hazard.

PROJECT DESCRIPTION: The study will consist of a lake ecosystem monitoring program. Samples will be taken from a "gradient" of lakes varying from those in pristine locations (atmospheric deposition of contaminants only) to others which received pointsource discharges of contaminants (eg. PCB laden road oil).

The obtained information would indicate the major pathways of the contaminants, as well as their fate in selected lakes.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	87.0	80.0	78.5	245.5
	Work Years:	3.2	3.6	3.6	10.4

Budget Source: RAC

KEYWORDS: Muskoka-Haliburton, organic aquatic contaminants, source, fate, persistence

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Trend Analysis Procedures for PWQMN  
Data Series

PROJECT NO: 278C  
START DATE: 08/87

SHORT TITLE: PWQMN Trend Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. A.I. McLeod  
McLeod-Hipel & Associates  
Ltd.

LIAISON OFFICER (name, location, telephone no.):

Dr. B. Bodo  
Water Resources Branch  
323-4823

OBJECTIVE(S): To develop operational statistical and graphical trend analysis procedures specifically for the PWQMN data base.

PROJECT DESCRIPTION: Compile representative data base. Conduct exploratory analysis to characterize fundamental data properties. Develop numerical and visual reporting formats. Develop trend analysis procedures and operational software.

Benefits: Significant upgrading of the level of analysis by MOE staff and outside data users. Enhanced capacity to assess degradation of water quality or improvements due to remedial action.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	20.0	20.0		40.0
	Work Years:	0.2	0.2		0.4

Budget Source: RAC

KEYWORDS: irregular water quality time series, trends

OUTPUT (papers, presentations, reports): 1. Robust trend assessment of water quality time series; 2. Abstract and poster 1987 Technology Transfer Conference

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Project is just getting underway, it should move into high gear within the next two months.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                        Grant                        Unsolicited X

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PROJECT TITLE: Assessment of the Influence of                      PROJECT NO: 279C  
Various Factors on Water Use Across Ontario - Stage I              START DATE: 08/86

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SHORT TITLE: Water Distribution Systems

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PRINCIPAL INVESTIGATOR AND AFFILIATION:                      A.P. Haslam & L.D. Smith  
Gore & Storries Limited

LIAISON OFFICER (name, location, telephone no.): W. Brink  
EALUP  
323-4499

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OBJECTIVE(S): To obtain a better understanding of the wide diversity in water consumption by various communities across the province so that future planning can be more effective.

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PROJECT DESCRIPTION: Development of the format for a computer data base for an IBM-PC and the entering of data (on water consumption and the known factors affecting consumption) where this is readily available.

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Benefits:

If influences on water demands in different settings are better understood, the relative priorities of conservation, leak detection and elimination, and increased production can be better established and an improved return on investment achieved.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	15.0				15.0
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Work Years:

Budget Source: RAC

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KEYWORDS: water consumption, water distribution systems

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant	Unsolicited X

PROJECT TITLE: Demonstration of Automated Jar Tester      PROJECT NO: 280C  
START DATE: 09/87

SHORT TITLE: Automated Jar Tester

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Mr. P. Crawford, Manager,  
Process Systems  
Zenon Environmental Inc.

LIAISON OFFICER (name, location, telephone no.): G. Martin  
Water Resources Branch  
235-5829

OBJECTIVE(S): 1. To demonstrate and evaluate the automated jar tester in "tracking" operation at water treatment plants.  
2. To evaluate the operational data collected, and assess the technical and economic impact of the automated jar test control system on plant operations.  
3. To recommend the most appropriate system configuration for on-line demonstration in subsequent phases.

PROJECT DESCRIPTION: Study carried out wherein the automatic jar tester will be demonstrated and evaluated through actual tracking of plant performance in the field. The experimental data collected will be evaluated, and the technical and economic significance of the system will be assessed.

Benefits:

1. Process diagnosis and optimization tool;
2. Lower labour requirements for plant operations, monitoring and data maintenance;
3. Process control based on automated measurement and feedback;
4. Provide a data base for prevention of unnecessary plant expansion or process changes.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	36.6				36.6
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Work Years:

Budget Source: RAC

KEYWORDS: water treatment, jar tester, control system

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Regional Analysis of Low-Flow  
Characteristics

PROJECT NO: 281C  
START DATE: 11/86

SHORT TITLE: Low Flow Characteristics

PRINCIPAL INVESTIGATOR AND AFFILIATION: H.S. Belore & C. Jarratt  
Cumming-Cockburn &  
Associates Ltd.

LIAISON OFFICER (name, location, telephone no.): Dr. L. Logan  
Water Resources Branch  
323-4989

OBJECTIVE(S): To develop a technique for providing estimates of low-flow  
characteristics for a watercourse based on the physical parameters of the  
watershed and to test it on a small sub-area.

PROJECT DESCRIPTION: Develop methodology for regional analysis of low-flow  
characteristics. Apply and test to small sub-area of Ontario.

By utilizing the relationship developed using the gauged watersheds, the  
hydrologic characteristics of streamflow can be estimated for any ungauged  
watersheds within the region.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	25.0	20.0			45.0
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Work Years:

Budget Source: RAC

KEYWORDS: low-flow hydrologic characteristics, estimation, physical  
parameters

OUTPUT (papers, presentations, reports): Poster - 1987 RAC Technology  
Transfer Conference

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Study of Some Factors Contributing  
to the Abundance and Persistence of Green Filament  
Algal Mats in Acidic Lakes

PROJECT NO: 282G  
START DATE: 09/86

SHORT TITLE: Algal Mats in Acidic Lakes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Pamela Stokes  
University of Toronto

LIAISON OFFICER (name, location, telephone no.):

M. Jackson  
Water Resources Branch  
235-5812

OBJECTIVE(S): To provide an explanation for the occurrence and persistence of  
algal mats in acidified lakes (pH 5.5) and to provide an explanation for the  
lack of accumulation and persistence of the mats in otherwise comparable  
habitats in less acidic lakes.

PROJECT DESCRIPTION: Selection of sample sites in two acidic lakes: initial  
examination of the algal mat community to determine its composition and to  
evaluate sampling methodology; investigation of the invertebrate fauna of  
algal mats for presence and activity of grazers.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	4	TOTAL
	Cost: (\$000's):	12.5	57.2	NIL	20.1	89.8
	Work Years:	0.4	1.1		0.6	2.1

Budget Source: RAC

KEYWORDS: algal mats, acidic lakes, grazers

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Effect of Fine Particles on The  
Respiratory Health of a Cohort of Young People

PROJECT NO: 283G  
START DATE: 09/86

SHORT TITLE: Respiratory Health

PRINCIPAL INVESTIGATOR AND AFFILIATION:

L.D. Pengelly & C.H. Goldsmith  
McMaster University

LIAISON OFFICER (name, location, telephone no.): W. Chan

Air Resources Branch  
965-4081

OBJECTIVE(S): To obtain epidemiological evidence in support of a fine particle standard based on data already collected using the Andersen 2000 Cascade Impactor.

PROJECT DESCRIPTION: Data on respiratory health, home environmental factors, and exposure to air pollutants (including size of suspended particles) are available for a cohort of 1900 Hamilton secondary school students covering the period from 1979 to 1986. These data will be analysed (in particular data obtained from 1982-1986) to determine the effects of fine particles (as defined using data from a network of Andersen 2000 cascade impactors) on the respiratory health of the cohort.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	61.3	83.7		145.0
	Work Years:	1.8	2.4		4.2

Budget Source: RAC

KEYWORDS: epidemiology, fine particles, air pollution

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X
	(transfer)	

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PROJECT TITLE: Development of a Control Strategy to Manage Dynamic Fluctuations in Trace Contaminants in Sewage Treatment Plant Effluents	PROJECT NO: 284C START DATE: 10/86
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SHORT TITLE: Sewage Treatment

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. H. Melcer  
Wastewater Technology Centre  
Environment Canada

LIAISON OFFICER (name, location, telephone no.): T. Ho  
Water Resources Branch  
323-4980

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OBJECTIVE(S): The overall objective is to develop a management strategy aimed at controlling the dynamic variations of trace contaminants in sewage treatment plant (STP) effluents. This strategy will address industrial waste discharge limitations, the impact of internal recycle streams on treatment plant performance and the dynamic response characteristics of treatment plant unit processes to non-steady state loadings of trace contaminants.

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PROJECT DESCRIPTION: Critical review of technical literature to compile information with respect to trace contaminants as it pertains to:

- i) variability of industrial discharges to municipal sewer systems;
  - ii) variability of raw influent to STPs and its impact on process performance;
  - iii) quality and impact of recycle streams on process performance;
  - iv) dynamic behaviour of treatment processes with respect to trace contaminants.
- 

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	60.0			60.0
	Work Years:	0.8			0.8

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Budget Source: RAC

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KEYWORDS: sewage treatment plants, effluents, trace contaminants, industrial waste

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies): Wastewater Technology Centre, CCIW, Environment Canada.

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Sinter Plant Stack Opacity  
Preconditioned Spray System

PROJECT NO: 285C  
START DATE: 10/86

SHORT TITLE: Stack Opacity

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Stelco Inc.  
Hamilton, Ontario

LIAISON OFFICER (name, location, telephone no.): J. Vogt

Hamilton District Office  
(416) 521-7732

OBJECTIVE(S): The objective is to determine the ability of the stelco-designed preconditioned water spray system to reduce sinter stack opacity and fine particle loadings. A bluish haze prevents the plume opacity from meeting MOE requirements. The aim is to achieve 20 percent stack opacity as prescribed by regulation 308.

PROJECT DESCRIPTION: A prototype, Stelco-designed, precondition spray system should improve sinter stack opacity to a level of 20 percent or less. Results are contingent upon the technical/cost effectiveness of the sprays to precondition and agglomerate submicron particle/hydrocarbon for removal at the venturi scrubber.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	30.0			30.0
	Work Years:				

Budget Source: RAC

KEYWORDS: sinter stack opacity, preconditioned spray system

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Methods of Measurement and Speciation  
of Mercury in Natural Waters and Its Use in Assessing  
Mercury Contamination in Huntsville Area Lakes

PROJECT NO: 286G  
START DATE: 10/86

SHORT TITLE: Mercury in Natural Waters

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Pamela Stokes  
Inst. for Environ. Studies  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): Dr. G. Mierle

Limnology Unit, Dorset  
(705) 766-2412

OBJECTIVE(S): To determine the source(s) of mercury and methylmercury to the  
Huntsville Lakes.

PROJECT DESCRIPTION: Streams, rivers and precipitation in the Huntsville area,  
will be monitored for mercury and methylmercury to determine the source of  
contamination to these lakes, and the effect of pH and sulphate changes will be  
described.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	81.5	65.5		147.0
	Work Years:	2.4	2.4		4.8

Budget Source: RAC

KEYWORDS: mercury, methylmercury, speciation, natural waters

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Field Trials of Developed DNA Probes for Determining Bacterial Pollution Source Inputs	PROJECT NO: 287G START DATE: 10/86
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SHORT TITLE: DNA Probes

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. W.C. Bradbury Toronto General Hospital University of Toronto
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LIAISON OFFICER (name, location, telephone no.): M. Young Laboratory Services Branch 235-5866
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OBJECTIVE(S): To determine the specificity in field trials of developed DNA probes (human, goose, gull) to trace and quantitate the sources of pollution at the Toronto Harbour Front.

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PROJECT DESCRIPTION: Isolates obtained from MOE Microbiology section laboratory, which have been collected from human, animal and bird feces will be analyzed in a "Bline" study by the DNA probes. The latter results will be compared with standard biochemical identifications. The DNA analyzed samples will then subsequently be sent back to the MOE microbiology laboratory for "Bline" confirmation.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	33.6			33.6
	Work Years:				

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Budget Source: RAC

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KEYWORDS: DNA probes, specificity, pollution source tracing

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Development and Critical Evaluation of a Dual Column Gas Chromatography Method for the Determination of Polycyclic Aromatic Compounds in Environmental Samples

PROJECT NO: 288G  
START DATE: 10/86

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SHORT TITLE: PAHs in Env. Samples

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M.A. Quilliam  
Department of Chemistry  
McMaster University

LIAISON OFFICER (name, location, telephone no.): J. Osborne  
Laboratory Services Branch  
235-5759

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OBJECTIVE(S): The development of a dual-column gas chromatography method for the routine analysis of polycyclic aromatic compounds in environmental samples, using retention indices and either general or selective detectors. The general detectors being a flame ionization (FID) or photo-ionization detector (PID) and the selective detectors being an electron capture (ECD) or a thermionic sensitive detector (TSD). In order to have an efficient protocol, a data base of GC retention indices for various polycyclic compounds will also be produced. Once the method has been developed the degree of confidence associated with the method will be obtained through a critical comparison of its data with that of GC/MS (gas chromatography/mass spectrometry), LC/DAD (liquid chromatography with a UV-VIS diode/array detector) and LC/MS.

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PROJECT DESCRIPTION: The chemical composition of environmental samples such as airborne particulates and sediments is very complex, consisting of hundreds of inorganic and organic components. A very important class of compounds in such samples are the polycyclic aromatic hydrocarbons and their derivatives. This project will attempt to develop and evaluate a routine dual-column GC method for the analysis of polycyclic aromatic compounds (PAC) and create a data base of retention indices for RAC identification.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	70.0			70.0
	Work Years:	1.1			1.1

Budget Source: RAC

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KEYWORDS: dual column gas chromatograph, polycyclic aromatic compounds

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Kirkland Lake Water Treatment Plant      PROJECT NO: 289C  
Alternative Process Research      START DATE: 01/87

SHORT TITLE: Kirkland Lake Water Treatment

PRINCIPAL INVESTIGATOR AND AFFILIATION:      D.R. Fisher, P. Eng.  
Proctor & Redfern Limited

LIAISON OFFICER (name, location, telephone no.): G. Martin  
Water Resources Branch  
235-5829

OBJECTIVE(S): 1. To study and compare alternative high rate pre-treatment processes with each other and with known operating data from other plants using conventional low rate systems.  
2. To study alternative coagulants on Northern Ontario waters.

PROJECT DESCRIPTION: Pilot studies of various high rate pre-treatment processes in conjunction with different filtration media gradations at varying filter rates and using alternative pre-treatment and coagulant chemicals.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	69.0			69.0
	Work Years:				

Budget Source: RAC

KEYWORDS: pre-treatment, coagulant, filtration, water treatment

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Prediction of Rate of Oxygen Depletion in Recreational, Urbanized and Agricultural Lakes      PROJECT NO: 294C  
START DATE: 11/86

SHORT TITLE: Oxygen Depletion in Lakes

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      W.J. Snodgrass  
Beak Consultants

LIAISON OFFICER (name, location, telephone no.):      B. Neary  
Water Resources Branch  
766-2418

OBJECTIVE(S):

- To relate the oxygen cycle to inputs of nutrients and dissolved organic carbon.
- To relate the model to fisheries potential data (if available).
- To test the model upon the Muskoka-Haliburton-Kawartha lakes, and recreational lakes subjected to agricultural/urban influences.

PROJECT DESCRIPTION:

- A model will be developed to relate oxygen consumption to inputs of nutrients and dissolved organic carbon.
- Laboratory measurements will be made to aid model calibration; particular measurements anticipated are sediment oxygen demand.
- The model's limitations will be assessed statistically.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	20.0	39.9	4.4	64.3
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Work Years:

Budget Source: RAC

KEYWORDS: eutrophication, dissolved oxygen, land use

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Slow Sand Filtration for Production  
of Drinking Water in Small Northern Communities

PROJECT NO: 296C  
START DATE: 11/86

SHORT TITLE: Slow Sand Filtration

PRINCIPAL INVESTIGATOR AND AFFILIATION:

W.J. Hargrave, P. Eng.  
Gore & Storrie Limited

LIAISON OFFICER (name, location, telephone no.):

J. Dart  
Water Resources Brnach  
323-4876

OBJECTIVE(S): To investigate the design, operation and maintenance of slow sand filtration for the treatment of drinking water in small northern communities.

PROJECT DESCRIPTION: 1. To assemble design, operation, maintenance and cost information on slow sand filtration.  
2. To evaluate simple chemical dosing systems, the potential colour removal, and to propose pilot test programs.

Successful completion of the study will provide information on design and operation of slow sand filtration systems.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		25.0	100.0	25.0	150.0
Work Years:		0.5	0.9	0.3	1.7

Budget Source: RAC

KEYWORDS: slow sand filtration, design, operation, maintenance cost, chemical dosing, colour removal

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Clay/Leachate Compatibility Study                      PROJECT NO: 299C  
Hydraulic Conductivity of Ottawa-Carleton "Leda" Clay                      START DATE: 03/87  
Barrier Soils Permeated with Domestic Waste Leachate

SHORT TITLE: Domestic Leachates

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. R.M. Quigley,  
Director of Geotechnical  
Research Centre  
University of Western  
Ontario

LIAISON OFFICER (name, location, telephone no.): R. Dunn  
MOE (SE Region)  
(613) 521-3450

OBJECTIVE(S): To assess the compatibility of four Leda Clay samples (from the Ottawa-Carleton region) with typical domestic waste leachate. The work would be used as input for environmental hearings associated with selection of future landfill sites on leda clay. The work was requested by MacLaren Engineers at the request of the Ontario Ministry of the Environment.

PROJECT DESCRIPTION: Four "typical" Leda clay samples would be supplied by Golder Associates (Ottawa) under the supervision of MacLaren Engineers. These samples would be subjected to permeation by domestic waste leachate to assess any changes in hydraulic conductivity. Extensive chemical analyses of both the influent and effluent liquids would indicate any retardation of selected soluble species.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	25.0			25.0
	Work Years:	0.4			0.4

Budget Source: RAC

KEYWORDS: Ottawa-Carleton Leda Clays, hydraulic conductivity, permeation, domestic leachate, soluble chemical retardation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Report submitted to Liaison Officer on August 2, 1988 for Review.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: An Intrinsic Chemically Selective Lipid-Based Wave Guide Organic Vapour Sensor	PROJECT NO: 300G START DATE: 02/87
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SHORT TITLE: Organic Vapour Sensor

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. U.J. Krull, Department of Chemistry, Erindale College University of Toronto
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LIAISON OFFICER (name, location, telephone no.):	Dr. E. Singer Air Resources Branch 965-4081
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OBJECTIVE(S): To prepare and study a novel integral optical sensor consisting of a chemically selective fluorescent lipid biomembrane which acts as a light guide. This system will be developed with the capability of being portable or remote, and will be able to provide sensitive long term detection of organic species of environmental significance.

PROJECT DESCRIPTION: A lipid membrane prepared as a multilayer of mono layer lipid films would be used as an optical wave guide using the principle of total internal reflection. The lipid matrix would be modified to contain an organic receptor, which would alter membrane physical chemistry as a result of selective binding. The alterations would be reported by fluorophores sensitive to membrane or receptor structure. This system would be inherently sensitive due to the sensitivity of fluorophore response, and the fact that the fluorescent signal would originate within the wave guide.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	11.5	11.5	11.5	34.5
	Work Years:				4.1

Budget Source: RAC

KEYWORDS: organic vapour sensors, lipid membranes, wave guide, sensors

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Fossil Chrysophycean Cyst Assemblages  
as Paleoindicators in Acidified Lakes

PROJECT NO: 301C  
START DATE: 02/87

SHORT TITLE: Paleoindicators

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Marijsz Rybak  
Aquatic Research & Ecological  
Consultants

LIAISON OFFICER (name, location, telephone no.): K. Nicholls

Water Resources Branch  
235-5810

OBJECTIVE(S):

- To establish new predictive techniques for reconstruction of long-term changes of pH and related chemistry in the lakes in the Province of Ontario.
- To describe chrysophycean fossil cyst assemblages from 52 lakes in Ontario.
- To analyze the relationship between chrysophycean cyst assemblages and lake water pH.
- To develop transfer functions.
- To determine the concentration of major oxides and trace elements in sediments.
- To develop a new technique to predict water chemistry characteristics (other than pH in acidified lakes).
- To prepare a guidebook for the identification of chrysophycean fossil cysts.

PROJECT DESCRIPTION: Data will be obtained from analysis of surface sediments of 52 lakes in Ontario. The detailed analysis of fossil chrysophycean cyst assemblages and geochemical analysis will be carried out. The statistical analysis will be used to develop new techniques for reconstruction of long-term changes of pH and related chemistry in the lakes in the Province of Ontario.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	26.5			26.5
	Work Years:	0.2			0.2

Budget Source: RAC

KEYWORDS: fossil chrysophycean cyst assemblages, paleoindicators, acidified lakes

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                      Grant                      Unsolicited X

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PROJECT TITLE: Technical and Economic Assessment of Reverse Osmosis for Treatment of Landfill Leachate                      PROJECT NO: 303C  
START DATE: 04/87

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SHORT TITLE: Reverse Osmosis

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PRINCIPAL INVESTIGATOR AND AFFILIATION:                      J.A. Coburn, Vice President  
of Technical Services  
Zenon Environmental Inc.

LIAISON OFFICER (name, location, telephone no.): Mr. A. Oda  
Waste Management Branch  
323-5129

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OBJECTIVE(S): 1. To evaluate the technical and economic benefits of reverse osmosis for treatment of landfill leachates.  
2. To carry out bench scale studies on landfill samples and to use the results to develop a process design for an optimized membrane-based treatment system.

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PROJECT DESCRIPTION: Reverse osmosis technology offers great promise in the area of landfill leachate treatment. The proposed study will establish the technical and economic feasibility and potential economic advantages of membrane technology for this application. Bench scale studies will be carried out on samples collected from a landfill chosen in conjunction with the scientific authority, and results will be used to develop a process design.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		49.6			49.6
Work Years:		1.25			

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Budget Source: RAC

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KEYWORDS: leachate characterization, treatment, membrane filtration, reverse osmosis, bench tests, cost analysis

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OUTPUT (papers, presentations, reports): Technology Transfer Conference (1987); Purdue Industrial Waste Conference, Purdue University (1988)

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Completed with draft of final report under review

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Provision of Isomerically Pure Nitro-PAH Analytical Standards      PROJECT NO: 304G  
START DATE: 03/87

SHORT TITLE: PAH Analytical Standards

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. V. Snieckus  
Guelph-Waterloo Centre for  
Graduate work in Chemistry  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): O. Meresz  
Laboratory Services Branch  
235-5762

OBJECTIVE(S):

1. To prepare, by short and efficient routes, several classes of nitro-PAHs, potent direct acting mutagens which are increasingly detected in the environment from a variety of sources. Nitro-PAHs to be prepared are a variety of isomers of: nitrofluorenes, nitrofluoranthenes, nitrophenanthrenes, and nitro benz(a)anthracenes.
2. Similarly, to prepare a series of hydroxylated derivative of the above classes of nitro-PAHs of interest as metabolites and products of atmospheric photochemical and chemical oxidation. Some of these have already been detected in air particulate extract.

PROJECT DESCRIPTION: The work is based on recent synthetic methodology developed in the researcher's laboratories using transition metal catalyzed cross coupling reaction between arylboronic acids and aryl halides. It will allow the preparation of up to 100 mg quantities of a number of highly pure nitro-PAHs and nitro-hydroxy-PAHs in a short time and with minimum handling of potentially toxic intermediates. Analytical purities will be established by HPLC, NMR, HPLC-MS, and GC-MS techniques. Once preparation methods are standardized, the work will be funded by the user Branch.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	36.9				36.9
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Work Years:

Budget Source: RAC

KEYWORDS: analytical standards, nitro-PAH's

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: An Evaluation of the Problems of Particulate Emissions from the Wood Products Industry  
PROJECT NO: 306C  
START DATE:

SHORT TITLE: Particulate Emissions from Wood Industry

PRINCIPAL INVESTIGATOR AND AFFILIATION: Rowan, Williams, Davis and Erwin Inc.

LIAISON OFFICER (name, location, telephone no.): R. Potvin  
MOE (NE Region)  
(705) 675-4501

OBJECTIVE(S): To evaluate the problems of particulate emissions from the wood products industry with emphasis on emissions resulting from the handling and storage of wood material; and to determine solutions aimed at ensuring compliance with Regulation 308.

PROJECT DESCRIPTION: The proposed study will take the form of a "literature search" to update current information on this matter, with a summary of what the industry is doing elsewhere and how other government/regulatory agencies are coping with these problems. The report would also provide conclusions/recommendations on the resolution of the problem with the likelihood of a requirement for additional research/study of the problem. These areas of research/study would need to be identified.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	33.1			33.1
	Work Years:				

Budget Source: RAC

KEYWORDS: wood, paper orhog fuel, dust, particle, fines, emission, fugitive erosion, control, monitor, regulate, abate

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Study completed; recommendations are under consideration and review by the Ministry for possible implementation.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Establishing Vegetation on Erosion-  
Prone Landfill Slopes in Ontario

PROJECT NO: 307C  
START DATE: 02/87

SHORT TITLE: Vegetation on Landfill Slopes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Thomas W. Hilditch  
Company Biologist  
Gartner Lee Associates Ltd.

LIAISON OFFICER (name, location, telephone no.):

D. McLaughlin  
Air Resources Branch  
965-4516

OBJECTIVE(S): To research, test and compile in an understandable and usable form the information and techniques necessary to remediate surface erosion problems through proper vegetation management at landfills across Ontario.

PROJECT DESCRIPTION: The first year of study will include:

- MOE District Abatement Officer Contact and Questionnaires.
- Contact with Revegetation experts in Canada and the United States
- Computer-based Literature Search and Review.
- On-Site Investigation of Selected Landfills Across Ontario.

In year two, experimental test plots using the best available plant species, site treatments and plenty of techniques will be established on 12 representative landfills across Ontario.

The third year of study will be devoted to the monitoring and analysis of test plot results and the creation of the Landfill Revegetation Manual.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	49.3	83.1	60.6	193.0
	Work Years:	0.4	0.9	0.7	2.0

Budget Source: RAC

KEYWORDS: landfill, erosion, vegetation, remedial actions

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Various municipale and private landfill operators/owners.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Enhanced Sanitary Landfill: A                      PROJECT NO: 308C  
Demonstration Trial                      START DATE: 04/87

SHORT TITLE: Enhanced Sanitary Landfill

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. B. Laughlin,  
B. Forrestal and P. Laughton  
Ontario Research Foundation

LIAISON OFFICER (name, location, telephone no.): A. Oda  
Waste Management Branch  
323-5129

OBJECTIVE(S): The overall objective of the proposed study is to demonstrate the efficiency of an enhanced landfill concept to permit rapid stabilization and increased capacity for municipal solid waste landfill sites.

PROJECT DESCRIPTION: A pilot scale anaerobic digester will be designed and installed to operate on leachate which is currently being collected at the Britannia Road Sanitary Landfill in Mississauga. The steady state operation phase will include leachate characterization, pilot plant specification and installation, acclimation, steady state operation and data analysis.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	195.0			195.0
	Work Years:				

Budget Source: RAC

KEYWORDS: leachate treatment, anaerobic digestion, gas production pilot study

OUTPUT (papers, presentations, reports): Technology Transfer Conference (1987); International Energy Agency Workshop; MSW to Energy, Fitzwilliam College, Cambridge, U.K. (June 1988)

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Detectability of Step Trends in the  
Rate of Atmospheric Deposition of Sulfate

PROJECT NO: 309G  
START DATE: 04/87

SHORT TITLE: Deposition of Sulfate

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. E.A. McBean  
Dept. of Civil Engineering  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): N. Reid

Air Resources Branch  
965-1634

OBJECTIVE(S):

1. Develop relationships defining the trade-off between the cost of acid deposition monitoring and time/network requirements to detect step trends in deposition levels.
2. To define the relative deposition variability associated with temporal, spatial and sample collection factors.

PROJECT DESCRIPTION: Comprehensive examination of existing monitoring records to isolate the sources of variability.

Rewrite the variability relationships to solve for the monitoring record duration necessary to recognize step deposition changes.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	15.2			15.2

Work Years:

Budget Source: RAC

KEYWORDS: atmospheric deposition, sulphates, step trends

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant	Unsolicited X

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PROJECT TITLE: Scale Model Studies and Development of Prediction Procedures for Heavy Gas Dispersion in Complex Terrain	PROJECT NO: 310C START DATE: 07/87
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SHORT TITLE: Gas Dispersion Model

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. P.A. Irwin Rown, Williams, Davies & Irwin Inc.
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LIAISON OFFICER (name, location, telephone no.):	P. Misra Air Resources Branch 235-5771
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OBJECTIVE(S): To develop a practical model for predicting the dispersion of dense gases that will make appropriate allowances for the effects of surrounding buildings and topography and that incorporates a methodology for predicting peak concentrations.

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PROJECT DESCRIPTION: The studies would be in two phases. Phase I consists of a Literature Review, Theoretical Studies, Wind Tunnel Tests and Computer Program Development for cases involving uniform arrays of obstacles such as buildings. Phase II will extend the studies to non-uniform arrays of obstacles and will also look at the effects of ground slopes, ditches, berms, etc. Since the full range of all possible terrain conditions cannot possibly be covered, a part of the studies will be to evaluate the uncertainties in the predictions to arrive at rational safety factors to use in conjunction with the predictions.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	102.0	118.0		220.0
	Work Years:	0.8	1.0		1.8

Budget Source: RAC

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KEYWORDS:

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Development of Multivariate Analysis Procedures for Ontario Air Quality Data	PROJECT NO: 311G START DATE: 04/87
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SHORT TITLE: Multivariate Analysis for Air Quality

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Philip K. Hopke  
Institute for Environmental Studies  
University of Illinois at Urbana-Champaign

LIAISON OFFICER (name, location, telephone no.): Dr. W. Chan  
Air Resources Branch  
965-4081

OBJECTIVE(S): 1. To determine if multivariate data analysis methods can extract evidence for long-range transport of acidic materials influencing the precipitation chemistry of samples collected by APIOS network.  
2. The establishment of a set of data analysis procedures to be applied to these data as they are accumulated so that such information can be routinely extracted as part of the on-going data interpretation efforts.  
3. The ability of target transformation factor analysis for extraction of source information for urban scale aerosol will be explored and, if successful, procedures will be established to incorporate this methodology in the techniques available to MOE for air quality management.

PROJECT DESCRIPTION: Various multivariate data analytical methods including nonhierarchical cluster analysis, principal components analysis, empirical orthogonal function, and three-mode principal components analysis will be applied to precipitation chemistry data and appropriate meteorological data to elucidate the origins of the observed components. In addition, the sources of urban particulate matter will be explored using principal components analysis and target transformation factor analysis.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (US \$000's):	27.8	29.6		57.4
	Work Years:	0.5	0.5		1.0

Budget Source: RAC

KEYWORDS: multivariate analysis, precipitation and air quality analysis

OUTPUT (papers, presentations, reports): Oral presentations at TTC, 1987 and 1988

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Modelling the Photochemical  
Decomposition of Chlorinated Phenols by Sunlight

PROJECT NO: 312G  
START DATE: 04/87

SHORT TITLE: Photochemical Decomposition of Phenols

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Nigel J. Bunce  
Dept. of Chemistry  
University of Guelph

LIAISON OFFICER (name, location, telephone no.):

N. Reid  
Air Resources Branch  
965-1634

OBJECTIVE(S): 1. To model the rate of decomposition of chlorophenols in the troposphere as assisted by sunlight;  
2. To identify the products of the above photochemical degradation;  
3. To establish the mechanisms by which these reactions take place.

PROJECT DESCRIPTION: This study consists of several parts, corresponding to the objectives above. The foremost question is to demonstrate whether chlorophenols degrade under sunlight and if so, how fast this reaction occurs environmentally. Following this, the reaction products will be investigated using GC-MS, and finally the reaction mechanism will be investigated using chemical trapping experiments.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		10.4	10.8		21.2
Work Years:		0.6	0.6		1.2

Budget Source: RAC

KEYWORDS: chlorophenols, atmospheric decomposition, sunlight, GC-MS, reaction mechanisms

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Physical and Chemical Processes                      PROJECT NO: 313G  
Affecting Long-Range Transport of Air Pollutants and                      START DATE: 08/87  
Acid Rain

SHORT TITLE: Processes Affecting LRTAP

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. Han-Ru Cho  
Department of Physics  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): R. Bloxam  
Air Resources Branch  
235-5772

OBJECTIVE(S): To gain better understanding of chemical, physical and dynamic processes in the earth's atmosphere affecting long-range transport of air pollutants and acid rain.

PROJECT DESCRIPTION: Some basic problems in chemical, physical and dynamic processes important to the modelling of long-range transport and acid rain will be studied. Emphasis will be placed on mesoscale atmospheric processes, and the possibility of incorporating them into long-range transport models.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		74.2	106.6	110.8	291.6
Work Years:		2.2	2.8	2.8	7.8

Budget Source: RAC

KEYWORDS: Long-range transport, air pollutants, acid rain, chemical and physical processes

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Atmospheric Trace Gas Measurements Using a Tunable Diode Laser Absorption Spectrometer	PROJECT NO: 314G START DATE: 04/87
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SHORT TITLE: Tunable Diode Laser Spectrometer

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Drs. D.R. Hastie and H.I. Schiff Faculty of Science York University
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LIAISON OFFICER (name, location, telephone no.):	Dr. M. Lusi Air Resources Branch 965-1634
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OBJECTIVE(S): To make measurements of atmospheric trace gas concentrations to aid in the understanding of the chemistry of both ozone and acid formation. The data will be directly applicable for evaluation of Eulerian models (RADM, and ADOM). The proposed measurements will be part of the Eulerian model evaluation study jointly sponsored by MOE, AES and USEPA.

PROJECT DESCRIPTION: The bulk of the measurement program will be related to the Eulerian Model Field Evaluation Study. For this the TDLAS will be located at the Ministry's site at Dorset for a total of four two-month periods so as to cover the four seasons within two years. The instrument will be capable of measuring the concentrations of two species simultaneously, the exact species to be measured will be selected in conjunction with Ministry personnel. The instrument should be available for other Ministry special projects as required.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	346.3	137.7	127.5	611.5
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Work Years:

Budget Source: RAC

KEYWORDS: Atmospheric tracegases, ozone, acid, Eulerian models, Tunable diode laser spectrophotometer

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

Atmospheric Environment Services - Environment Canada, and US-EPA

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: The Effects of Forestry Operations  
Upon the Environment of Ontario

PROJECT NO: 315G  
START DATE: 04/87

SHORT TITLE: Forestry Operations

PRINCIPAL INVESTIGATOR AND AFFILIATION:

D. Huff  
The Federation of Ontario  
Naturalists

LIAISON OFFICER (name, location, telephone no.): W. McIlveen

Air Resources Branch  
965-4516

OBJECTIVE(S): To review relevant literature, concepts and practices pertaining to the environmental effects of forestry operations focussing in particular on the ecosystem dynamics, chemicals used in forestry operations and on economic ramifications. To also establish and assess the economic and social cause and effect linkage between these environmental effects.

PROJECT DESCRIPTION: The work will be guided by a Peer Review Committee, composed of academics and or consultants, a project coordinator, and a member of the Federation of Ontario Naturalists. Four contracts will be carried out to provide information on ecosystem dynamics, chemicals, air and water quality, socio-economic and cultural aspects, economic implications, and environmental progress. Each contract will comprehensively review and evaluate the literature and current practices and will be synthesized to form one final report, outlining the state of the environment as it relates to forestry operations.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	100.0			100.0
	Work Years:	1.0			1.0

Budget Source: RAC

KEYWORDS: forestry operations, environmental impact

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: A Study of the Economic Factors Relating to the Implementation of Resource Recovery, Recycling or Zero-Discharge Waste Reduction Technologies for Heavy Metal Generating Industries in Canada

PROJECT NO: 316C  
START DATE: 04/87

SHORT TITLE: Heavy Metal Industries

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Bernard Fleet  
Dept. of Chemistry  
University of Toronto

LIAISON OFFICER (name, location, telephone no.):

R. Warner  
Waste Management Branch  
323-5196

OBJECTIVE(S): The study will provide an evaluation of the economics of recycling technologies specifically aimed at some key industrial sources of pollution, namely the metal finishing, printed circuit board and related electronic industries. The concepts, technologies and systems should also be transferrable to a significant segment of Ontario's mining industry.

PROJECT DESCRIPTION: The economic studies would first involve an evaluation of the costs for various technologies to achieve specific levels of treatment efficiency. Secondly, an economic model would be developed which would allow comparison of recycling vs conventional treatment costs and would provide sensitivity analysis to allow effect of various factors to be evaluated. Thirdly, a cost comparison of various strategies for implementation of a given recycling technology would be presented. Finally, three case studies would be carried out to apply practical utilization of economic data to development of optimal waste management strategies.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		13.0	63.5		76.5
Work Years:		0.6	0.6		1.2

Budget Source: RAC

KEYWORDS: heavy metal waste, treatment options, efficiency economics

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Quantitative Structure-Activity Relationships for Organic Compounds and Their Mixture  
PROJECT NO: 317G  
START DATE: 04/87

SHORT TITLE: QSAR for Organics

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. George W. Ozburn and L. McCarty  
Department of Biology  
Lakehead University

LIAISON OFFICER (name, location, telephone no.): N. Bazinet  
Water Resources Branch  
323-4929

OBJECTIVE(S): To enhance and refine QSAR techniques employing the organic chemical toxicity database at Lakehead University. To develop physiologically and environmentally realistic toxicity models using Lakehead and literature data.

PROJECT DESCRIPTION: Use the organic chemical database of Lakehead University's ATRG in conjunction with literature information to:

1. Refine and expand relationships between molecular descriptors, acute and chronic aquatic toxicity test results, and bioconcentration;
2. Investigate biological and environmental factors which may influence the accurate determination of the above relationships and examine methods of compensation and correction;
3. Study data and relationships and develop simple one-compartment first-order kinetics models for the prediction of toxicant body burdens and the time course of toxicant action;
4. Examine the possibility of using more sophisticated modelling techniques to improve predictive capabilities and incorporate provisions for mixtures of toxicants as well as accounting for certain biological and environmental factors which may influence the outcome.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		43.3	51.7	40.0	134.9
Work Years:		0.7	1.0	0.3	2.0

Budget Source: RAC

KEYWORDS: organic compounds, quantitative structure-activity relationship, toxicity, physiological and environmental toxicity models

OUTPUT (papers, presentations, reports): Technology Transfer 1987, Technology Transfer 1988. Paper presented at International Conference on Environmental Bioassay Techniques and Their Application.

EXTERNAL PARTICIPATION (ministries, governments, agencies): University of Waterloo

COMMENTS: Several Publications are expected from this research.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: The Long-Term Effects of Acute and Sub-chronic Pentachlorophenol Exposures on the Growth and Lipid Reserves of Centrarchid Fish	PROJECT NO: 318G
	START DATE: 04/87

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SHORT TITLE: Pentachlorophenol Exposure

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. Peter H. Johansen Department of Biology Queen's University
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LIAISON OFFICER (name, location, telephone no.):	G. Westlake Water Resources Branch 235-5797
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OBJECTIVE(S): To determine the effects of pentachlorophenol exposure (chronic and acute) to growth and lipid reserves of centrarchid fish over a several week period upon return to uncontaminated water.

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PROJECT DESCRIPTION: In the first year investigator will develop the food conversion efficiency feeding technique around a new food item not previously used by the investigator and hopefully complete the acute and sub-chronic exposure experiments. The experimental season, when small bluegill sunfish are available, is limited to 6 to 9 months.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	13.3	10.4		23.7
	Work Years:				

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Budget Source: RAC

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KEYWORDS: pentachlorophenol, fish, feeding, growth, lipids

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: An Examination of the Chronic Toxicity of Thiocyanate to Freshwater Fish for the Development of a Water Quality Criterion

PROJECT NO: 320G  
START DATE: 04/87

SHORT TITLE: Thiocyanate

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. D. George Dixon  
Assistant Professor  
Department of Biology  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): C. Neville  
Water Resources Branch  
235-5799

OBJECTIVE(S): To obtain sufficient data on the chronic toxicity of thiocyanate to fish to establish a water quality criterion. To examine the toxicity of short-term pulse exposure of SCN- to fish. To apply the lab derived biochemical and histological indicators of SCN- impact to fish in the White River system.

PROJECT DESCRIPTION: The objectives will be met by four experiments. First, groups of rainbow trout will be continuously exposed to sublethal concentrations of SCN- for 16 weeks. Toxicity will be assessed in terms of growth, thyroid metabolism and SCN- Kinetics in blood plasma. The second experiment will determine the effects of continuous exposure to SCN-, over one life cycle, on the reproductive capacity of fathead minnow. Experiment three will pulse-expose rainbow trout for 2 h to varying concentrations of SCN-, after which they will be reared for 6 weeks. Toxicity will be assessed as in experiment one to facilitate comparison. All results will be analysed to determine no effect levels. Finally, we will assess the health of white sucker populations in lakes of the White River System of Ontario receiving SCN- effluent. Assessment will be made in terms of age-size, reproduction, histopathology and thyroid metabolism.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	35.0	36.8	39.9	111.7
	Work Years:	2.0	2.0	2.0	6.0

Budget Source: RAC

KEYWORDS: thiocyanate, chronic toxicity, fish, criterion development, lab/field

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: The Effects of Agricultural Drainage  
on Sediment and Water Quality Loadings

PROJECT NO: 321G  
START DATE: 04/87

SHORT TITLE: Effects of Drainage

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. W. Edgar Watt  
Dept. of Civil Engineering  
Queen's University

LIAISON OFFICER (name, location, telephone no.):

Dr. L. Logan  
Water Resources Branch  
323-4989

OBJECTIVE(S): To develop, calibrate and verify a model to simulate the effects of agricultural land use and drainage on the sediment and water quality loadings to receiving streams. To provide guidance on the use of the model to evaluate potential management strategies.

PROJECT DESCRIPTION: This study involves (i) the development, calibration and testing of a physically-based model for predicting sediment and water quality/loadings to receiving waters from agricultural lands; (ii) instrumentation of fields and sub-basins in an agricultural basin; (iii) associated field studies and (iv) applications of the model to assessment of hypothetical management practices affecting water quality.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		31.0	30.0	29.0	90.0
Work Years:		1.0	1.2	1.2	3.4

Budget Source: RAC

KEYWORDS: pollutant loadings, drainage, agricultural land predictive model

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Biomonitoring Protocols for Adult  
Aquatic Insects

PROJECT NO: 322G  
START DATE: 04/87

SHORT TITLE: Aquatic Insects

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Jan J.H. Ciborowski  
Dept. of Biological Science  
University of Windsor

LIAISON OFFICER (name, location, telephone no.): A. Hayton

Water Resources Branch  
235-5800

OBJECTIVE(S): To develop procedures to collect adult insects to assess the degree of contamination of waters from which they have emerged. To evaluate seasonal variations in contaminants in the Huron-Erie connecting channel. To assess the transfer of contaminants from aquatic to terrestrial systems via adult insects.

PROJECT DESCRIPTION: Research will develop efficient unmanned modes of trapping adult insects. Collections and analyses will evaluate appropriate sample sizes required for adequate detection of contaminants, likely distances from source that insects are attracted and optimal season for collection.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	38.6	38.3		76.9
	Work Years:	1.2	1.3		2.5

Budget Source: RAC

KEYWORDS: biomonitoring, trace contaminants, invertebrates

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Development of Liquid Crystal  
Capillary Columns for Analysis of Polychlorinated  
Dioxins and Furans by GC/MS

PROJECT NO: 323G  
START DATE: 04/87

SHORT TITLE: Crystal Capillary Columns

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. F.W. Karasek  
Dept. of Chemistry  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): R. Clement  
Laboratory Services Branch  
235-5896

OBJECTIVE(S): Under this project, work will be undertaken to develop the selective liquid crystal phases and fabricate capillary columns for separation of PCDDs, PCDFs and PAHs in environmental mixtures.

PROJECT DESCRIPTION: A direct analysis of environmental samples by GC/MS needs selective capillary columns. Liquid crystals are the selective stationary phases that have shown high selectivity for separation of various structural isomers, polyaromatic compounds (PAC) and 2,3,7,8-tetrachlorodibenzo-p-dioxin, that is not possible using conventional capillary columns. However, such polymeric liquid crystal capillary columns are not readily available. Liquid crystalline polymer stationary phases having polysiloxane and polyacrylate backbones with liquid crystalline moieties as side chains will be developed for capillary columns. The selectivity of such columns will be determined using standard isomeric mixtures that are impossible to separate on conventional capillary columns. The correlation between the structure of liquid crystalline polymer and its selectivity will be established. The newly developed columns will be applied to the analysis of environmental samples.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	42.5	42.5
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Work Years: 1.1 1.1

Budget Source: RAC

**KEYWORDS:** polychlorinated dioxins and furans, GC/MS, liquid crystal capillary

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Procedure for the 2,3,7,8-Substituted Analysis of PCDD, PCDF and Other Target Compounds in Environmental Samples      PROJECT NO: 324G  
START DATE: 04/87

SHORT TITLE: Procedures-Target Compounds, Dioxins, Furans

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. F.W. Karasek  
Dept. of Chemistry  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): C. Tashiro  
Laboratory Services Branch  
235-5897

OBJECTIVE(S): The present method of analysis of PCDD and PCDF does not provide sufficient separation of the most toxic isomers of these compounds. This proposal will utilize a two-step high performance liquid chromatographic fractionation to replace the present multi-step liquid chromatographic procedure. Once the method has been optimized to separate quantitatively the 2,3,7,8-substituted isomers it will also provide simultaneous determination of a wide variety of other organic pollutants.

PROJECT DESCRIPTION: The two-step HPLC fractionation procedure developed for project 210 PL will be rigorously optimized and tested for the analysis of the 2,3,7,8-substituted PCDD and PCDF in a variety of samples supplied by MOE. A large number of samples will be studied in order to optimize the fractionation procedure for the routine analysis of target compounds including PCDD, PCDF, PCB, pesticides, and polycyclic aromatic hydrocarbons (PAH). Ultimately the HPLC method will be designed such that it will be amenable to automated analysis. Upon finalization of the method, MOE will receive a working HPLC and their staff will be trained to complete the technology transfer of the HPLC procedure. Criteria will be established for the identification and determination of 2,3,7,8-TCDD, 2,3,7,9-TCDF, and various other target compounds found in the samples analyzed.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		92.0			92.0
Work Years:		1.1			1.1

Budget Source: RAC

KEYWORDS: dioxins, furans, chemical analysis

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Preparation of Heterocyclic  
Polynuclear Aromatic Hydrocarbons for Analytical  
Standards

PROJECT NO: 325G  
START DATE: 04/87

SHORT TITLE: PAH Synthesis

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. E. Lee Ruff  
Department of Chemistry  
York University

LIAISON OFFICER (name, location, telephone no.):

J. Osborne  
Laboratory Services  
235-5759

OBJECTIVE(S): To prepare specific thiophene and carbazole PAH's that are related to mutagenic carbocyclic analogues for reference standards in environmental analysis. Once these compounds are synthesized the second portion of the project will be to monitor the fate of these compounds under simulated environmental oxidations, providing information on their relative stability.

PROJECT DESCRIPTION: The synthesis of the compounds are based on two independent methods involving cyclobutanones and arylmethyl cations substituted by a thiocarbonyl group which were developed by the investigator. The preparation of the triophenes is based on the latter whereas the carbazole preparation is based on the former route. Furthermore, the synthesized thiophenes will be subjected to controlled simulated environmental conditions. This will involve primarily self-sensitized photooxidation studies.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	24.0	24.0		48.0
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Work Years:

Budget Source: RAC

KEYWORDS: synthesis, polynuclear aromatic hydrocarbons, analytical standards

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



Solicited  
Unsolicited X

PROJECT NO: 326G  
START DATE: 04/87

SHORT TITLE: Expert System for QA/QC

Dr. Martin J. Stillman  
Department of Chemistry  
University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): J. Hipfner  
Laboratory Services Branch  
235-5856

OBJECTIVE(S): The development of a generic expert system for use as a quality control and quality assurance program in the analytical laboratory. The study will involve the design and implementation of a prototype system software.

- Designing prototype expert systems software;
  - designing rule and knowledge database structure,
  - designing user interface,
  - designing a general instrument communication interface,
- Designing instrumental analysis quality control programs;
- Implementation of the expert system designs;
- Development of AAS data model and elucidation of human expertise for AAS.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	54.1			54.1
	Work Years:	1.5			1.5

Budget Source: RAC

KEYWORDS: expert system, QA/QC, chemical analysis

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Solid-supported Isolation and Derivatization - An Approach to Automation of Environmental Organic Analysis	PROJECT NO: 327G
	START DATE: 04/87

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SHORT TITLE: Solid-Supported Isolation and Derivatization

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.M. Rosenfeld  
Department of Chemistry  
McMaster University

LIAISON OFFICER (name, location, telephone no.): D. Hall  
Laboratory Services Branch  
235-5910

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OBJECTIVE(S): The development of a technique utilizing a XAD-2 resin for an adsorbent as well as a support for analytical derivatization of organic compounds.

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PROJECT DESCRIPTION: These objectives will be met through a systematic study of the variables to the reaction on the scale required for environmental analysis. They will be part of on-going studies on the chemistry of solid supported reactions on XAD-2 and other non-ionic macroreticular resins and application of this class of new reagents to analytical problems. The major focus of application will be the eventual development of robotics as a flexible analytical tool capable of addressing a majority of analytical requirements.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	35.0	38.0		73.0
	Work Years:	1.1	1.1		2.2

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Budget Source: RAC

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KEYWORDS: organic analysis, automation, XAD-2 resin, solid-supported isolation and derivatization

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Refinement and Testing of a  
Preconcentration Sampler for Dioxins in Water

PROJECT NO: 329G  
START DATE: 04/87

SHORT TITLE: Dioxins in Water

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Bryan R. Hollebone  
Dept. of Chemistry  
Carleton University

LIAISON OFFICER (name, location, telephone no.): H. Tosine

Laboratory Services Branch  
235-5906

OBJECTIVE(S): To develop an automated preconcentration water sampler for the analysis of raw/treated water for chlorinated dioxins and dibenzofurans, and to deliver to MOE a final, tested prototype suitable for field work.

PROJECT DESCRIPTION: This is a one year project to complement design and operation modifications identified in the completed initial trials. Specifically:

- 1) Capacity and convenience of operation of filter systems will be improved;
- 2) Duplication of adsorption streams will be implemented with improved adsorption column designs; and,
- 3) Surrogate spike chemicals will be tested with improved spiking apparatus.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	60.0				60.0
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Work Years:	1.5				1.5
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Budget Source: RAC

KEYWORDS: preconcentration sampler, dioxins, chemical analysis

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: In Situ Assessment of Mixed Copper and Zinc Impacts on White Sucker (*Catostomus commersoni*) Populations in Several Northern Ontario Lakes: an Evaluation of the Environmental Health Assessment to Validating Water Quality Criteria

PROJECT NO: 193G&331G  
START DATE: 04/85

SHORT TITLE: Mixed Copper & Zinc Impacts

PRINCIPAL INVESTIGATOR AND AFFILIATION: D. George Dixon  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): C. Neville  
Water Resources Branch  
235-5799

OBJECTIVE(S): This study represents an integrated field - laboratory program designed to determine the impacts of metal contamination on the white sucker populations of several lakes in the Manitouwadge district of Ontario. Metal effects will be assessed predominantly in terms of reproductive capacity, and survival of larval fish. The program will fulfill the stated research needs of the Ministry: 1) the development of in-situ and ecosystem indicators of water quality impairment, and 2) validation of a water quality criteria - objective approach to limiting the detrimental effects of aquatic contaminants, 3) To determine the impacts on Manitouwadge lakes, 4) To fully evaluate difference in growth, larval survival and larval resistance to metals as well as provide information on additional lakes.

PROJECT DESCRIPTION: This study will follow seasonal changes in gonad development, serum steroid levels and gamete viability in white suckers sampled from lakes, in the Manitouwadge chain, representing low, moderate and elevated levels of copper and zinc contamination. The fish will also be examined for histopathological evidence of a reaction to the elevated metal levels. During the second phase of the project, fertilized gametes from representative lakes will be returned to the University of Waterloo and examined for abnormalities in development and/or growth. Simultaneous toxicity tests will determine the possibility of genetic input to altered relative metal tolerance.

In order to validate assessment models it is necessary to isolate and identify factors associated with the altered health of the white sucker populations. More information is required on the nutritional and energy status of the fish, maternal factors associated with increased metal tolerance and effects of cross-fertilizations between lakes. This additional information will provide the strongest database for future comparisons of additional studies on ecosystem health in degraded environments.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	38.8	31.9	38.2	108.9
	Work Years:	1.5	1.5	1.8	4.8
Budget Source: RAC					

KEYWORDS: trace metals, white sucker, water quality criteria

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Development of an Expert System for  
Decision Making with Regard to Water Quality in  
Ontario Rivers

PROJECT NO: 250G&332G  
START DATE: 05/86

SHORT TITLE: System for Water Quality

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. T.E. Unny  
Dept. of Systems Design  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): L. Logan

Water Resources Branch  
323-4984

OBJECTIVE(S): To develop an expert system for applications in decision making  
with regard to water quality in Ontario Rivers with the objective to;

- 1) provide a basis for the assessment of uncertainties in water quality parameters;
- 2) develop a procedure to determine the effect of random variations in these parameters in decision making; and,
- 3) fill in the knowledge base of parameter specific toxicity and test the prototype system and modify the program.

PROJECT DESCRIPTION: MOE manages Water Quality Monitoring at strategic locations in Ontario rivers with the objective to assess the effect on water quality, the impact of waste water discharges from municipal and industrial plants and of diffuse sources of wastes from agricultural and other land uses.

Readings on water quality are taken at frequent intervals (generally at the rate of one reading a month) on 65 tributaries. The readings include hydrological parameters (streamflow), physical parameters (temperature, turbidity, etc.) and nutrient parameters.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	27.5	27.5	27.5	82.5
	Work Years:	1.0	1.0		2.0

Budget Source: RAC

KEYWORDS: expert system, water quality, Ontario rivers

OUTPUT (papers, presentations, reports): Interim report, 1986; Paper presented at AGU Conference, 1987.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Slow Rate Infiltration Land  
Treatment and Recirculation of Landfill Leachate  
in Ontario

PROJECT NO: 333G  
START DATE: 04/87

SHORT TITLE: Recirculation of Leachates

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. R.A. McBride  
Land Resource Science  
University of Guelph

LIAISON OFFICER (name, location, telephone no.):

A. Oda  
Waste Management Branch  
323-5129

OBJECTIVE(S): To evaluate slow rate infiltration land treatment of leachate  
in forest/agricultural areas.  
2. To evaluate recirculation of leachate as partial treatment.

PROJECT DESCRIPTION: This is a three year research study which will achieve  
the above objectives through the establishment of pilot-scale installations  
and the implementation of perturbation experiments at four sites across  
Ontario. Intensive characterization and monitoring of the more important  
biotic and abiotic ecosystem components will be carried out. Landfill  
recirculation will also be investigated as a means of pretreatment prior to  
slow rate infiltration land application, by lessening both leachate volume and  
strength.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		171.2	147.8	128.4	447.4
Work Years:		6	6	6	

Budget Source: RAC

KEYWORDS: leachate treatment, land application, recirculation, soil  
infiltration, irrigation (spray, trickle, sub-surface), effects on vegetation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).







## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of the Backfill and Construction Application Guidelines - Phase II

PROJECT NO: 336C  
START DATE: 04/87

SHORT TITLE: Inert Fill Guidelines

PRINCIPAL INVESTIGATOR AND AFFILIATION:

G. Zukovs  
Division Manager  
CANVIRO Consultants Ltd.

LIAISON OFFICER (name, location, telephone no.):

R. Dalrymple  
Waste Management Branch  
323-5211

OBJECTIVE(S): To identify Ontario sites where industrial waste has been/is being used as backfill, to carry out a comprehensive study of the impact; to assess changes with time; to assess draft guidelines developed in Phase I.

PROJECT DESCRIPTION: Phase II work will primarily involve detailed bulk quality characterization and leachate testing of backfill material from selected sites, as well as site hydrogeologic investigations and the uses of these data in the criteria assessment exercise. In addition, changes to the Phase I work as per previous discussions will also be included in the Phase II work.

BUDGET AND RESOURCES:	Year: (* current)	1 87-88	2* 88-89	3	TOTAL
Cost: (\$000's):		21.9	173.1		195.0
Work Years:		1.0	1.0		

Budget Source: RAC

KEYWORDS: inert fill guidelines, landfill testing, quality evaluation

OUTPUT (papers, presentations, reports): MOE Guideline on Inert Fill

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Control of Nuisance Blue-Green Algal Blooms in Eutrophic Waters Via Enhancement of Aerobic Microbial Respiration

PROJECT NO: 337C  
START DATE: 06/87

SHORT TITLE: Control of Blue-Green Algal Blooms

PRINCIPAL INVESTIGATOR AND AFFILIATION: Lewis Molot  
Molot Environmental Services

LIAISON OFFICER (name, location, telephone no.): H. Vandermeulen  
Water Resources Branch  
235-6046

OBJECTIVE(S): To enhance the recreational value of eutrophic (nutrient-rich) waters by preventing dominance of phytoplankton communities by nuisance blue-green algae. The proposed remedy is enhancement of aerobic microbial respiration via optimization of aeration strategy.

PROJECT DESCRIPTION: Laboratory studies of algal growth and competition are proposed using two species isolated from Heart Lake - Microcystis sp., which was the dominant blue-green alga in 1986, and a eucaryotic alga dominant in May or June of 1987. The effects of a range of P and CO<sub>2</sub> on growth and cellular transport of CO<sub>2</sub>, HCO<sub>3</sub> - and P will be investigated first in single species, continuous culture.

Parameters such as growth rate, intracellular phosphorus content, yield and transport affinities for P, CO<sub>2</sub> and HCO<sub>3</sub> - (Miller et al. 1984) will be measured. It is hoped that a relationship will help define the mechanism by which P and CO<sub>2</sub> affects the outcome of competition between algae.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	27.4				27.4
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Work Years:

Budget Source: RAC

KEYWORDS: blue green algae, encaryotic algae, pand CO<sub>2</sub>, competition, control of bluegreen blooms

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Sulphur and Oxygen Isotope Composition in Aqueous Sulphate in a Dorset Watershed and Their Role in Acid Rain Sulphur Cycle PROJECT NO: 338G  
START DATE: 05/87

SHORT TITLE: Sulphur & Oxygen Isotope Composition

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Peter Fritz  
Dept. of Earth Sciences  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): P. Dillon  
Water Resources Branch  
Dorset  
(705) 766-2412

OBJECTIVE(S): To gain a better understanding of the fate and biochemical history of sulfate between fallout and runoff in a terrestrial watershed. Specifically, to assess the chemical processes affecting the isotopic composition of the soil sulphur compounds.

PROJECT DESCRIPTION: The ongoing project involves detailed monitoring of the sulphur and oxygen isotopic composition of sulphur compounds in soils and other interacting reservoirs. The investigators are sampling precipitation, throughfall, stemflow, spring, stream, bog and lake waters, in addition to soils and soil waters. The investigators will continue the study, focusing on the chemical processes affecting the isotopic composition of the soil sulphur compounds.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		32.5			32.5
Work Years:		1.2			1.2

Budget Source: RAC

KEYWORDS: acid rain sulphur cycle, Dorset watershed

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Technology Review of Biological  
Treatment of Trace Level Toxicants in Landfill  
Leachates

PROJECT NO: 339C  
START DATE: 04/87

SHORT TITLE: Toxicants in Landfill Leachates

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. J. Fein and  
Dr. Peter Fu  
Diversified Research  
Laboratories Limited

LIAISON OFFICER (name, location, telephone no.):

R. Khettry  
Water Resources Branch  
323-5226

OBJECTIVE(S): To evaluate the current status of biological treatment  
technologies applied to toxic industrial leachates - literature review and  
interviews.

PROJECT DESCRIPTION: An indepth report will be prepared, based on:

1. Comprehensive literature search using standard reference materials and  
on-line data bases;
2. Interviews with experts in field; and
3. Discussions with appropriate regulatory agencies in Canada and the U.S.A.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	31.8			31.8
	Work Years:	0.2			0.2

Budget Source: RAC

KEYWORDS: landfill, leachate, biological treatment, hazardous wastes,  
degradative micro-organisms/bacteria

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: The Development of a Procedure to Evaluate the Erosion of Landfill Covers and the Development of a Lysimeter to Determine Whether or Not Infiltration is a Significant Factor in the Design of Soil Covers

PROJECT NO: 340C  
START DATE: 07/87

SHORT TITLE: Landfill Covers Erosion/Infiltration

PRINCIPAL INVESTIGATOR AND AFFILIATION: K. McKague  
Agricultural Engineer  
Ecologistics Limited

LIAISON OFFICER (name, location, telephone no.): C. Bostock  
Waste Management Branch  
323-5218

OBJECTIVE(S):

1. To evaluate the effect of climatic and environmental factors on the stability of landfill covers with respect to erosion.
2. To evaluate the performance of lysimeters installed in a landfill for use as tools in the study of landfill cover infiltration.
3. Research and evaluate current landfill cover design.

PROJECT DESCRIPTION:

1. Develop a preliminary micro computer model as a basic tool for the design of soil covers for landfills.
2. Monitor six preliminary lysimeters for the exploration of experimental techniques regarding infiltration through soil covers.
3. Develop and undertake a set of field experiments to validate and finalize the model.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	75.0				75.0
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Work Years:

Budget Source: RAC

KEYWORDS: landfill covers, erosion, infiltration, lysimeter

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Phase 1 is to end September 30, 1988. Anticipated date for start of Phase 2 is April 1989. A proposal has been submitted for a small project to monitor the lysimeters during the interval between the end of Phase 1 and the start of Phase 2.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Study of the Discharge of Grey Water  
from Pleasure Boats

PROJECT NO: 341C  
START DATE: 06/87

SHORT TITLE: Grey Water Disposal From Pleasure Boats

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Beak Consultants Limited

LIAISON OFFICER (name, location, telephone no.): D.J. Birnbaum  
Approvals Branch  
323-4502

OBJECTIVE(S): 1) To determine the amount of 'grey water' and 'black water' produced by three types of pleasure boats in Ontario.  
2) To determine the bacterial characteristics of grey water in Ontario pleasure boats, specifically with regard to E. Coli, fecal Coliform, Pseudomonas Aeruginosa and Staphylococcus Aureus with regard to three types of pleasure boats.  
3) To evaluate the effects on the receiving recreational waters of the discharge of this grey water.  
4) Should it be decided, as a result of this study and other factors, that grey water must be retained on board for later disposal, to estimate whether the capacity of existing pumpout facilities in Ontario is adequate.

PROJECT DESCRIPTION:

- Determination of quantity of both grey and black water produced on board selected boats.
- Bacterial analysis of grey water obtained on board, and of receiving water in areas where pleasure boats discharge grey water.
- Analysis and evaluation of these findings for their environmental significance.
- A survey of the capacity of pumpout facilities in five selected areas of the province, and estimate of the capacity of existing pumpout facilities to accept an enhanced amount of sewage.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	87.7			87.7
	Work Years:	0.6			0.6

Budget Source: RAC

KEYWORDS: Grey and black water, bacteria, disposal, environmental effects

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Plant Bioassays for the Detection of Environmental Mutagens in an Aquatic Environment	PROJECT NO: 342G START DATE: 06/87
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SHORT TITLE: Plant Bioassay

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. W.F. Grant Department of Biology York University
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LIAISON OFFICER (name, location, telephone no.):	Dr. M. Salamone Water Resources Branch 235-5790
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OBJECTIVE(S): To develop bioassays with higher plant systems which will address the impact of industrial effluents on the aquatic environment.

To use short term high plant bioassays for the detection of environmental mutagens and to make recommendations on the genetic nature (mutagenicity) of effluents and selected compounds.

PROJECT DESCRIPTION: Three higher plant short-term mutagenicity assays will be used. The assay systems will include a) The Tradescantia Stamen Hair Assay for the detection of mutations, b) The Tradescantia Micronucleus Assay for the Detection of chromosome aberrations and, c) The VICIA FABA Chromosome aberration assay. These assays will be used to develop bioassays with higher plant systems which will address the impact of industrial effluents on the aquatic environment. The development of a facility with an artificial substrate will allow for the imbibition or diffusion of a liquid through the substrate to be taken up by higher plants for the monitoring of the aquatic effluents. In addition, these assays will be applied to effluents and other compounds selected by the Ministry. The assay systems developed for detecting mutagenicity of industrial effluent on plants will be evaluated as well as selected compounds.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	72.5	76.5		149.0
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Work Years:

Budget Source: RAC

KEYWORDS: insitu, plant, mutagenic assay, environmental monitoring.

OUTPUT (papers, presentations, reports):  
1st annual progress report submitted, paper in progress.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Metal Contamination of Wetland Food Chains in the Bay of Quinte, Lake Ontario

PROJECT NO: 343G

START DATE: 06/87

SHORT TITLE: Metal Contamination/Wetland Food Chains

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. A. Crowder  
Queen's University

LIAISON OFFICER (name, location, telephone no.): J. Overton  
Water Resources Branch  
235-5803

OBJECTIVE(S): To determine whether metal contamination caused by old mine sites in the upper Moira Valley and in the Bay of Quinte is affecting wetland food chains in the lower valley and the Belleville/Big Bay area.

PROJECT DESCRIPTION: Sediments in the Bay of Quinte are contaminated with Pb, Co, Ni, Cu, Hg, etc. Areas of the bay have low diversity in biomass of plants and few birds. Wetland sediments, macrophytes, muskrat and frog tissues will be analysed for metal content to see if there is high contamination in area of low biomass. Levels of metals in the suspect area will be compared to those in Hay Bay. If elevated metals are found in sediment, detritus or plant, then detritivores and herbivores will be tested. Macrophyte transplant experiments will also be carried out.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
Cost: (\$000's):		24.4	23.9		48.3
Work Years:					

Budget Source: RAC

**KEYWORDS:** Metals, Contamination, Diversity, Foodchain

OUTPUT (papers, presentations, reports): Shoreline distribution of contaminants and submerged macrophytes in Bay of Quinte, Ontario (@Trace Metals in Great Lakes Conference, Hamilton, Ontario, Aug'88); Determination of metals contamination in wetlands in the Bay of Quinte, Lake Ontario, Canada (@Conference on Bioassay Techniques, Lancaster, England

EXTERNAL PARTICIPATION (ministries, governments, agencies): Concurrent studies funded additionally by the World Wildlife Fund.

COMMENTS: An update on the field year's (1988) activities has been requested and promised before end of August 1988. Na+ seems to play an important role in the region of the study.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



Solicited  
Unsolicited X

PROJECT TITLE: In Situ Determination of Fecal Indicator Bacteria Survival in Agriculturally Impacted Watersheds

PROJECT NO: 344G  
START DATE: 11/87

SHORT TITLE: Watershed Indicator Bacteria

PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Walters  
Lake Simcoe Conservation  
Authority

LIAISON OFFICER (name, location, telephone no.): W. Lammers  
Water Resources Branch  
424-3000

OBJECTIVE(S): 1. To document and investigate the seasonal variations in bottom sediments and water columns, including the environmental factors that may influence bacterial survival.

2. To provide bacterial survival data required to develop a transport model and to assess the contribution of individual inputs from agricultural sources on beaches.

PROJECT DESCRIPTION: Development of hydrologic transport model to establish the potential boundaries and impact of a source(s) on beach areas. The identification of sources that affect the water quality of beach areas is required for successful targeting of remedial efforts. Successful completion of this study will provide the Lake Simcoe Region and Metro Toronto and Region Conservation Authorities with the bacterial survival information required for input into pollution transport models and the completion of pollution control plans.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	61.0	67.5	25.5	154.0
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Work Years:

Budget Source: RAC

KEYWORDS: bacteria, survival, transport, source contributions

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited X  
INTERNAL                      Grant                      Unsolicited

PROJECT TITLE: Disposal of Hauled Sewage Under Part VII, Environmental Protection Act      PROJECT NO: 345C  
START DATE: 11/87

SHORT TITLE: Waste Disposal/Hauled Sewage

PRINCIPAL INVESTIGATOR AND AFFILIATION:      O.M. Mangione  
McCalla and Associates Ltd.

LIAISON OFFICER (name, location, telephone no.): B.J. Cooper  
Environmental Approval  
Section 323-4503

OBJECTIVE(S): To produce a Report that:  
° describes current hauled sewage treatment and disposal practices;  
° characterizes hauled sewage as to quantity and quality;  
° provides overview of problems re treatment and disposal of hauled sewage;  
° discusses options available for future treatment/disposal

PROJECT DESCRIPTION: ° General introduction re purposes of report and abstract and recommendations and findings  
° Review of current practices in the 6 MOE Regions of Province and of Health Units with Regions  
° Literature review re characteristics of hauled sewage  
° Review and summary of regulations etc. in the USA, other parts of Canada and comparison and suggested improvements  
° Outline of options for improvement of present system, together with their implications (environmental, economic, public health, etc.)

Benefits

° There are clearly severe problems building within hauled sewage program in Ontario. This is essential background information for indicated change of policy, regulations, etc.

BUDGET AND      Year: (\* current)      1      2\*      3      TOTAL  
RESOURCES:

Cost: (\$000's):      24.5      38.5      63.0

Work Years:

Budget Source: RAC

KEYWORDS: hauled sewage, treatment, disposal, characterization problems and options, EPACT, part III

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of Ambient Air Monitoring Methodologies for Dioxins and Furans  
PROJECT NO: 346C  
START DATE: 11/87

SHORT TITLE: Dioxin/Air Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION: Wellington Environmental Inc.

LIAISON OFFICER (name, location, telephone no.): T. Dann  
Environment Canada

OBJECTIVE(S): 1. To validate and document designs for filtration/sorbent hi-volume sampling and analysis of dioxins and furans in ambient air filter and PUF samples.  
2. To utilize the developed method for obtaining dioxins and furans data at selected locations and use the data to establish QA/AC procedures for air sampling and analysis.

PROJECT DESCRIPTION: 1. To review current activities including data bases.  
2. To evaluate air sampling and analysis procedures and carry out related intercomparison study.  
3. To discuss the developed technologies at a special workshop and apply them to specific areas.  
4. To identify qualified laboratories capable of performing future work and their certification.

This study is jointly funded by Ontario, B.C., Alberta and Environment Canada. Successful completion of the research will provide the proponents with a state-of-the-art technology on dioxin and furans in air.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	30.0	to be determined
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Work Years:

Budget Source: RAC/CCREM

KEYWORDS: Filtration/sorbent, QA/QC procedures, dioxins, furans

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Joint funding by CCREM Research Advisory Committee and provinces of BC, Alberta with Environment Canada.

COMMENTS: Budgets for years 2 and 3 to be determined on completion of year 1.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Determination of Source-Receptor Links by Size-Specific Multielemental Inorganic Component Determination and Modelling PROJECT NO: 347G START DATE: 11/87

SHORT TITLE: Inorganic Compounds/Receptor Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION: R.E. Jervis  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): P. Steer  
Air Resources Branch  
965-4081

OBJECTIVE(S): It is proposed to do sufficient repeat sampling at selected locations and analyze for 20-25 trace elements to permit source profiles to be established and receptor modelling to be performed. If particle size-sorting is necessary, it is particularly important for analytical methods to be sensitive in the microgram range and lower for each filter and fraction.

PROJECT DESCRIPTION: Study of the MOE Sault Ste. Marie filters by neutron activation for purpose of revealing particularly steel and iron works contribution. In Toronto, do more on sampling in vicinity of refuse/waste incinerators. Identify sets of key marker elements and attempt particle size measurements as input to modified receptor modelling. Compare chemical mass balance (CEB), TTFA and APCA receptor approaches using the data sets obtained.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	33.6	32.9	26.8	93.3
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Work Years:

Budget Source: RAC

KEYWORDS: neutron activation, receptor modelling, source apportionment

OUTPUT (papers, presentations, reports): Paper for 1988 Technology Transfer Conference

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Eulerian Model Evaluation Study	PROJECT NO: 348G
	START DATE: 09/87

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SHORT TITLE: Eulerian Model

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M. Alvo  
University of Ottawa

LIAISON OFFICER (name, location, telephone no.): R. Bloxam  
Air Resources Branch  
235-5772

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OBJECTIVE(S): To assess the sensitivity and capabilities of MOE's ADOM model. To study the limitations of the statistical methods used and to suggest improvements. To address problems that arise because models produce ensemble averages, but are evaluated against grid data.

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PROJECT DESCRIPTION: It is proposed to develop a good understanding of the MOE Eulerian model, its capabilities as well as its limitations with respect to model prediction. The mathematical aspects of model evaluation will be addressed.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	63.5			63.5
	Work Years:				

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Budget Source: RAC

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KEYWORDS: Air Eulerian Model, Evaluation

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Critical Evaluation of Atmospheric  
Pollutant Parameterization From Satellite Imagery

PROJECT NO: 349G  
START DATE: 11/87

SHORT TITLE: Atmospheric Pollutants/Satellite Imagery

PRINCIPAL INVESTIGATOR AND AFFILIATION:

N. O'Neil  
University of Sherbrooke

LIAISON OFFICER (name, location, telephone no.): D. Yap

Air Resources Branch  
235-5773

OBJECTIVE(S): In point form the specific tasks to be carried out are:

1. Evaluation of the optical and physical parameters which can be realistically measured from the current generation of satellite sensors.
2. Analysis of the specificity of the optical and physical parameter information with respect to particular atmospheric pollutants.
3. Threshold analysis with respect to the minimum detectable concentration of pollutants.
4. Investigation into the effects of surface concentration change and altitude profile variation of particular pollutants on the simulated satellite signals.

PROJECT DESCRIPTION: Completion of tasks 1 through 4.

Having established a sensitivity hierarchy for the parameters of interest one is in a position to determine which if any inversion methodologies will be optimal for extracting information on a given atmospheric pollutant. The final phase of the simulation studies will thus be an analysis of inversion approaches appropriate to a given range of environmental and operational parameters.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	18.0				18.0
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Work Years:

Budget Source: RAC

KEYWORDS: atmospheric pollutants, optical and physical parameters, satellite sensors, specificity, threshold, simulation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Response of Sugar Maple Seedlings (Acer Saccharum) to Aluminum Stress as Measured by Acid Phosphatase Activity (Nutrient Stress), Rhizosphere pH (Al avoidance) and Root Organic Acid Content (Al detoxification)

PROJECT NO: 350G  
START DATE: 11/87

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SHORT TITLE: Sugar Maple Seedlings/Aluminum Stress

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PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Havas  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): W. McIlveen  
Air Resources Branch  
965-4516

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OBJECTIVE(S): To test response of sugar maple seedlings to elevated concentrations of aluminium (part of acid-deposition hypothesis), with specific reference to phosphorus deficiency (acid phosphatase activity), aluminium-avoidance (rhizosphere pH), and aluminium-detoxification (root organic acids).

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PROJECT DESCRIPTION: Laboratory study and field study (of healthy and dying trees)

- ° acid phosphatase activity - measure following exposure to Al in Water culture
- ° root organic acids - characterize and quantify in roots before and after Al exposure. Relate sensitivity to type and amount of organic acids.
- ° rhizosphere pH - measure acid-neutralizing capacity of roots and relate to Al uptake
- ° rank Al - sensitivity using a histochemical stain - and test this technique

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	31.9	54.2		86.1
	Work Years:				

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Budget Source: RAC

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KEYWORDS: sugar maple seedlings, aliminum, response measurements

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Experimentally Determine Mutation Rates in Lung and Bronchial Epithelia as Primary Air Pollution Standard  
PROJECT NO: 351G  
START DATE: 09/87

SHORT TITLE: Air Pollution Standard

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J. Heddle  
York University

LIAISON OFFICER (name, location, telephone no.): M. Salamone  
Water Resources Branch  
235-5790

OBJECTIVE(S): To develop a quantitative preliminary standard for mutagenic carcinogens in the atmospheric environment and in the workplace by the measurement of mutation rates in the target cells themselves - the epithelium of the lung and bronchus.

PROJECT DESCRIPTION: The study will proceed in three phases:

1. The development of techniques for the isolation, purification, identification culturing and examination of lung and bronchial epithelial cells.
2. Determination of appropriate assay conditions for detection of diphtheria toxin resistant mutants.
3. Measurement of mutation rates produced by known mutagenic carcinogens active in lung and bronchus.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):			97.2	97.2
	Work Years:				

Budget Source: RAC

KEYWORDS: mutation rates, air pollution, lung and bronchial epithelia

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Relationship of Sugar Maple Decline and Corresponding Chemical Changes in Sap Composition (Carbohydrates and Trace Elements)	PROJECT NO: 352G
	START DATE: 11/87

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SHORT TITLE: Sugar Maple Decline

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	D.N. Roy University of Toronto
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LIAISON OFFICER (name, location, telephone no.):	W. McIlveen Air Resources Branch 965-4516
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OBJECTIVE(S): A. To investigate organic and trace elemental composition of sap from healthy trees (DI 10.0) to establish the base-line information. (DI = decline index)  
B. To compare the results with the sap exudates from low (DI - 18-30), medium (DI - 31-50) and highly (DI 51) declined trees.  
C. To establish the chemical index (CI) of maple decline in selected sites in Ontario.  
D. To compare the chemical data (CI) with the external indexing system (DI) of MOE and IES group.  
E. To relate CI to known indices of climatic, site, atmospheric, and biological variables (which are either already observed or are in the process of being consolidated) in a cause-effect manner.

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PROJECT DESCRIPTION: This proposal addresses the possible relationship of sugar maple decline and consequent chemical changes in sap composition, which might correlate with the degree of decline. Ten maple trees (5 healthy and 5 declining) are selected from ten sites across the NE-SW gradient of Ontario. Sap exudates will be collected from these trees at various intervals during the spring. Detailed analyses of carbohydrates and trace elements will be performed using High Pressure Chromatographic and Instrumental Neutron Activation techniques, respectively. After establishing the base-line of chemical composition of sap from healthy trees, a system of chemical indexing the decline will be devised as a possible "early warning system".

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	19.9	19.3	15.2	54.4
	Work Years:				

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Budget Source: RAC

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KEYWORDS: sugar maple, decline index (DI), chemical index (CI), indices relationship

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

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PROJECT TITLE: Analysis of Provincial Fisheries  
Mercury Data, Phase I: Identification of Temporal,  
Spatial and Species Relationships

PROJECT NO: 353C  
START DATE: 09/87

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SHORT TITLE: Mercury in Fish

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PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Wren  
B.A.R. Environmental

LIAISON OFFICER (name, location, telephone no.): W.A. Scheider  
Water Resources Branch  
323-4925

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OBJECTIVE(S): To determine if there is a statistical correlation between  
mercury levels in select species of sportfish and in lake sediments.

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PROJECT DESCRIPTION: Compilation and cross correlation of Hg data available  
for various fish species and for lake sediment and in some cases lake water Hg  
levels.

Statistical analysis of the correlation of the datasets.

Examination of the feasibility of using digital computer mapping to display  
fisheries Hg data.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	26.4			26.4
	Work Years:	0.2			0.2

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Budget Source: APIOS

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KEYWORDS: mercury sport fish, statistical correlation, lake sediments

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Lake Water Quality Monitoring Based on Remotely Sensed Data: Phase II	PROJECT NO: 354G START DATE: 11/87
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SHORT TITLE: Water Quality/Remote Sensing

PRINCIPAL INVESTIGATOR AND AFFILIATION:	J. Roger Pitblado Laurentian University
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LIAISON OFFICER (name, location, telephone no.):	W. Keller MOE (NE Region) (705) 675-4501
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OBJECTIVE(S): The long term aim is to aid in the establishment of a lake water quality monitoring program for Ontario based on the principles and techniques of remote sensing. This is envisaged as a primary inventorying and monitoring program in which relatively rapid, general assessments of the surface water resources of the Province or parts of the Province would be made. The immediate aim of this project is to characterize/map/classify the lakes (in terms of general trophic state as well as discriminating between acidified and non-acidified lakes) of three major areas on the Precambrian Shield using remotely sensed data.

PROJECT DESCRIPTION: Associations between lake surface water parameters and spectral reflectance data from the Landsat TM sensor are to be derived for all lakes in three regions of Ontario: a) a 140,000 sq.km. area of Northeastern Ontario, centred on Gogama; b) a 40,000 sq.km. area, centred on Dorset-Haliburton; and c) a 40,000 sq.km. area in Northwestern Ontario to be selected in consultation with the MOE. Lake water parameters, such as DOC and Secchi depth, will be estimated for these lakes using regression approaches; lake classifications, with an emphasis on general trophic status, will be derived from the optical features of the lakes as measured by satellite reflectances by employing some standard image analysis techniques in conjunction with multivariate statistical procedures.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	49.0	40.0	34.0	123.0
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Work Years:

Budget Source: RAC

KEYWORDS: landsat, thematic mapper, acidification, trophic status

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Geochemical Characterization, Size Fractionation and Bioavailability of Trace Metal Particulate Associations in the Don River	PROJECT NO: 355G
	START DATE: 11/87

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SHORT TITLE: Trace Metal in Don River

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Ann P. Zimmerman  
University of Toronto

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LIAISON OFFICER (name, location, telephone no.): D. Boyd  
Water Resources Branch  
323-4949

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OBJECTIVE(S):

- To provide information on trace metal transport by suspended solids in the Don River.
  - To provide information on the potential bioavailability of metals associated with particular geochemical or size classes.
  - To provide information allowing MOE to determine the potential effectiveness of management actions directed towards improved water quality in the Toronto area watershed.
- 

PROJECT DESCRIPTION:

- Geochemically characterize and size fractionate suspended solids in the Don River.
  - Determine associations of Cd, Cu, Pb, Zn and Cr with specific particle size and geochemical classes of suspended particulates.
  - Determine whole body metal burdens of in situ Don River benthic communities.
  - Analyze ecological impact on benthic and pelagic compartments of solids reductions using laboratory-based microcosm bioassays.
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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	19.1	12.4		31.4
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Work Years:

Budget Source: RAC

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KEYWORDS: suspended sediment, metals, bioavailability, Don River

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OUTPUT (papers, presentations, reports): Scientific Paper(s)

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Development of a Hydrologic Model to Predict the Environmental Fate of De-icing Salts	PROJECT NO: 356G START DATE: 02/88
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SHORT TITLE: Hydrologic Model/De-icing Salts

PRINCIPAL INVESTIGATOR AND AFFILIATION:	K.W.F. Howard University of Toronto
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LIAISON OFFICER (name, location, telephone no.):	P. Beck Water Resources Branch 323-4890
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OBJECTIVE(S): To develop a hydrologic salt and water balance model that will predict, on a catchment scale, the long-term environmental fate of many tens of thousands of tonnes of road de-icing chemicals applied annually to Ontario's highways, streets, paths and sidewalks. Essential features of this model include as follows: 1) It will be based on sound hydrologic principles and incorporate recent developments in our understanding of overland and shallow sub-surface contaminant flow processes (including mixing and ion exchange); 2) It will consider application of both NaCl and CaCl<sub>2</sub> and be concerned with the fate of Na and Ca, as well as Cl; 3) It will be developed for a specific catchment(s), but will be sufficiently versatile and flexible for use in other catchments; 4) It will predict long-term chemical changes of water quality in groundwaters, lakes and rivers; 5) It will be developed for ease of use with the eventual user in mind.

PROJECT DESCRIPTION: The study is phased over 3 years and, while primarily desk-oriented, will involve elements of field and laboratory investigation. Primary elements include: a) acquisition and critical assessment of all available and existing methodologies for catchment salt balance circulations; b) development of salt/water balance catchment model incorporating both new and existing technologies; c) selection of a catchment suitable for model testing and calibration; d) acquisition of baseline data pertinent to selected study catchment(s); e) acquisition of additional input data through field and laboratory study; f) testing and calibration of the new model; g) preparation of the final report.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	31.9	33.4	33.4	98.7
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Work Years:

Budget Source: RAC

KEYWORDS: deicing salts, environmental fate, hydrologic salt and water balance model

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

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PROJECT TITLE: Assessment of Contamination Migration      PROJECT NO: 357G  
from Industrial and Landfill Sources in the Twelve      START DATE: 11/87  
Mile Creek and Welland River Watersheds and Their  
Impact as Inplace Pollutants in Sediments

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SHORT TITLE: Contamination Migration, Twelve Mile Creek

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PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Ian D. Brindle  
   Brock University

LIAISON OFFICER (name, location, telephone no.):      S. Irwin  
   West Central Region  
   521-7704

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OBJECTIVE(S):

- To determine the industrial and agricultural sources and classes of organic contaminants and toxic metal concentrations in the Twelve Mile Creek and Welland River.
  - To estimate contaminant loadings of in place pollutants in sediments.
  - To attempt to correlate the findings with the toxicity study currently being carried out with World Wildlife Fund (WWF).
  - To establish a realistic model for the distribution and fate of the identified contaminants in sediments along the above water courses.
- 

PROJECT DESCRIPTION: Detailed chemical analysis will be carried out on samples obtained from the Welland River and Twelve Mile Creek in an effort to identify the impact of in-place pollutants in sediments on the aquatic ecosystem, by investigating the availability of trace organics and heavy metals, in sediments, to biota. QA/QC will be maintained by liaison with MOE labs and by participation in round-robin analyses by the IJC.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	91.2	64.0		155.2
	Work Years:				

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Budget Source: RAC

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KEYWORDS: organic and toxic metal contaminants, source determination, in-place sediment pollutants, contamination migration

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Causes of Pollution Associated  
Neoplasms in Fish in Lake Ontario

PROJECT NO: 358G  
START DATE: 11/87

SHORT TITLE: Water Pollution/Neoplasm in Fish

PRINCIPAL INVESTIGATOR AND AFFILIATION:

M.A. Hayes  
University of Guelph

LIAISON OFFICER (name, location, telephone no.):

D. Rokosh  
Water Resources Branch  
235-5787

OBJECTIVE(S): Evaluation of the significance of cancers in wild fish as sentinels for pollution of late sediments with chemicals that are potentially harmful to humans that drink the water, eat the fish or work in the industrial sites discharging into Hamilton Harbour.

PROJECT DESCRIPTION: The studies are focussed on the biochemical basis of carcinogen sensitivity of Hamilton Harbour fish that do or do not develop liver tumors. We need to see which of the affected or unaffected fish most resemble human susceptibility.

The work will enable us to have a better chance of finding carcinogenic pollutants and evaluating their potential to be harmful to humans. This knowledge is essential for regulatory decisions relating to controlling and, if necessary, clearing up the harmful discharges into Hamilton harbour.

This work will facilitate decisions for the Ontario Ministry of the Environment and the local Hamilton Authorities who are developing a plan to deal with accumulated and future discharges into this densely populated industrial region of Ontario.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	73.0	67.5	140.5
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Work Years:

Budget Source: RAC

KEYWORDS: fish, tumours, etiology

OUTPUT (papers, presentations, reports): Progress report October, 1988, Technology Transfer Conference November, 1988.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Adaption of Water Preconcentration  
Techniques of Trace Metal Detection

PROJECT NO: 359G  
START DATE: 11/87

SHORT TITLE: Trace Metals/Preconcentration Techniques

PRINCIPAL INVESTIGATOR AND AFFILIATION:

B. Hollebone  
Carleton University

LIAISON OFFICER (name, location, telephone no.):

P. Vijan  
Laboratory Services Branch  
235-5834

OBJECTIVE(S): To design and build a pre-concentration sampler to permit larger numbers of large volume samples to be acquired in the field from raw and treated water supplies for trace metal analysis. To accomplish this, filtration and ion-exchange techniques for the extraction of the trace metals from water samples will be developed and incorporated in the pre-concentration sampler.

PROJECT DESCRIPTION: In the course of this two year project, procedures for the extraction of trace metals from water samples using filtration and ion-exchange techniques will be developed and tested. These procedures will be incorporated into a preconcentration sampler for the analysis of trace metals in raw and drinking water to be used in the field. The design and construction of the preconcentration sampler will be based on the technology developed for a similar sampler that has been constructed for the analysis of dioxin in water samples. In addition, procedures for the clean-up and analysis of the preconcentrated trace metals will be developed. The preconcentration sampler and related methodology for analysis of trace metals will be tested to demonstrate the detection limits and reproducibility.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	74.0	41.0		115.0
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Work Years:

Budget Source: RAC

KEYWORDS: trace, metals, preconcentration, water, ion-exchange

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Determination of Group IV Elements for Air Filters	PROJECT NO: 360G START DATE: 09/87
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SHORT TITLE: Metals in Air Filters

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. I.D. Brindle  
Brock University

LIAISON OFFICER (name, location, telephone no.): N. Reid  
Air Resources Branch  
965-1634

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OBJECTIVE(S): To develop a methodology for the determination of germanium, tin and lead in particulate matter collected on air filters.

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PROJECT DESCRIPTION: The determination of the Group IV elements will proceed stepwise to find the best conditions for the determination of each element. Then an attempt will be made to find the optimum conditions for the determination of all these elements simultaneously.

The final result should be a convenient analytical methodology, applicable to atomic absorption and atomic emission machines adapted for hydride determination.

The benefits for the determination of the sector of origin of particulates may be possible, since this method allows the determination of germanium, in particular. Germanium is not readily or accurately determined by neutron activation.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	44.3				44.3
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Work Years:

Budget Source: RAC

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KEYWORDS: air filters, AAS, AES, hydride determination, group IV elements

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OUTPUT (papers, presentations, reports): Paper submitted to "The Analyst"

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Nature of Substrates in Industrial Wastes Relative to Elemental Leachability

PROJECT NO: 361G  
START DATE: 09/87

SHORT TITLE: Industrial Wastes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. J.R. Kramer  
McMaster University

LIAISON OFFICER (name, location, telephone no.): J. Pimenta

Laboratory Services Branch  
235-5854

OBJECTIVE(S): To develop a sophisticated analytical protocol for the determination of potential toxic metal mobility from industrial wastes. The protocol would contain testing steps specific to different types of wastes (eg. smelters, iron industry, domestic sludges, industrial sludges, metal plating).

PROJECT DESCRIPTION:

- This protocol combines both solid state and chemical characterizations: X-ray diffraction, X-ray fluorescence, electron microscopy, selective chemical extraction, surface area analysis. A new chemical test, emphasizing reducing conditions is developed.
- Results from the different tests are grouped according to source of waste.
- Results from the OME provisional "Leaching and Toxicity Test" are compared to results from this procedure.
- A final protocol is developed and tested. This protocol combines sensitivity of method with cost and time effectiveness; it contains simple screening tests with more involved follow-up procedures.

Note: This is a third and final year of a three year study (total budget \$98,250).

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	35.1	35.1
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Work Years: 0.8 0.8

Budget Source: RAC

KEYWORDS: elemental leachability, industrial wastes, toxic metal mobility

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Continuation of Projects 187 and 290.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Determining the Integrity of  
Solidified Wastes by Large Scale Leach Columns Under  
Environmental and Controlled Conditions

PROJECT NO: 362G  
START DATE: 09/87

SHORT TITLE: Solidified Wastes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. D.W. Kirk  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): M.B. Fielding

Waste Management Branch

OBJECTIVE(S): To evaluate the leachability and determine the impact of municipal refuse interaction of solid industrial waste (steel flue gas dust) with various solid waste/municipal waste combinations. The primary goal of the study is to quantify the rate of release and mobility of metal and organic species from the large column experimental test cells. The secondary goal is to predict the long term natural leaching of solid wastes.

PROJECT DESCRIPTION: There are 16 experimental test cells that have been designed and put into operation on the roof of the University of Toronto Chemical Engineering building. These cells have operated year round over two winter periods without failure. The columns represent simulated municipal refuse landfill operations with various combinations of solid industrial waste and municipal refuse under both controlled and atmospheric conditions. There are 33 parameters that are routinely measured and collated. The test cells are approaching anaerobic conditions.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		51.0	46.6	48.9	146.5
Work Years:		1.5	1.5	1.5	4.5

Budget Source: RAC

KEYWORDS: solid industrial waste, rate of release, municipal refuse landfill operations

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Phase Partitioning at Industrial  
Waste Land Treatment Sites Under Non Steady-State  
Conditions

PROJECT NO: 363G  
START DATE: 08/87

SHORT TITLE: Waste Treatment/Phase Partitioning

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. W. Snodgrass  
McMaster University

LIAISON OFFICER (name, location, telephone no.): R. Weiler

Hazardous Contaminants Branch  
323-5103

OBJECTIVE(S): The objective of this study related to the mobility of toxic organic compounds in industrial waste land treatment systems. Particular emphasis is placed on nonsteady-state effects such as would be most important in abandoned or decommissioned sites. Specific objectives are:

- to determine the kinetics of adsorption, desorption, volatilization and water - waste partitioning in industrial waste land treatment systems;
- to develop a model to describe transport and kinetic effects;
- to test ability of model to predict observed behaviour from soil column study of non steady-state infiltration and waste application;
- to use model to simulate behaviour of operating land treatment sites and to evaluate decommissioning and cleanup alternatives.

PROJECT DESCRIPTION: Three toxic organics representative of the wide range of contaminants in industrial waste land treatment system will be used for the lab component of the study. Two types of lab work will be conducted:

- batch experiments to define kinetics for 3 toxics, 2 soils;
- application of wastes with radio-labelled toxic organics to soil columns to obtain data for model evaluation;

The modelling component of the study also has two phases:

- existing models will be assessed and new models developed to describe dynamics of transport and kinetics of phase partitioning in land treatment systems;
- models will be applied to practical management questions.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	14.056			14.056
	Work Years:	0.375			0.375

Budget Source: RAC

KEYWORDS: toxic organic compounds, mobility, wasteland treatment, non steady-state, model development

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

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PROJECT TITLE: Effects of Increasing Amounts of                      PROJECT NO: 364G  
Non-Polar Organic Liquids in Domestic Waste Leachate                      START DATE: 09/87  
on the Hydraulic Conductivity of Clay Liners in  
Southern Ontario

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SHORT TITLE: Leachate/Clayey Soil Liners

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PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. R.M. Quigley  
   Faculty of Eng. Science  
   University of Western Ontario

LIAISON OFFICER (name, location, telephone no.): M. Goodwin  
   Waste Management Branch  
   323-5217

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OBJECTIVE(S): To extend the current project 213PL, by one additional year in order to complete the evaluation of the effects of liquid hydrocarbons in domestic waste leachate on the hydraulic conductivity of compacted clayey soils used for liners below sanitary landfills.

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PROJECT DESCRIPTION:

- Complete some long-term k tests on brown clays to equilibrium with the dissolved inorganic species such as potassium;
  - Complete a set of 4 to 8 tests on grey Sarnia Clay not yet studied.
  - Undertake some preliminary lyophobicity experiments to explore the rejection of dissolved organics from the "salty" clay double layers.
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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	24.0			24.0
	Work Years:				

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Budget Source: RAC

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KEYWORDS: domestic waste leachate, liquid hydrocarbons, hydraulic conductivity, clayey soil liners, landfills

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: The Psycho-social Impacts of Exposure to Environmental Contaminants in Ontario (Feasibility Study)  
PROJECT NO: 365G  
START DATE: 09/87

SHORT TITLE: Environment Contaminant Exposure Impact

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. M. Taylor  
McMaster University

LIAISON OFFICER (name, location, telephone no.): G. Zegarac  
Policy and Planning Branch  
323-4578

OBJECTIVE(S):

- To develop a protocol for a study of the psycho-social of exposure to environmental contaminants in Ontario.
- To critically appraise the research literature on the psycho-social impacts of exposure to environmental contaminants.
- To develop a conceptual model of the process linking exposure to environmental contaminants and psycho-social impacts.
- To assess the strengths and weaknesses of feasible research designs for the study of psycho-social impacts.
- To review the implications for public education of the psycho-social impacts of exposure to environmental contaminants.

PROJECT DESCRIPTION: The Canadian Mental Health Association (Ontario Division) in collaboration with a highly experienced university research team requests funding for one year to support the development of a research protocol which would be the basis for a major study of the psycho-social impacts of exposure to environmental contaminants in Ontario. This submission is a direct response to the Ontario Ministry of Environment's stated need for research on the social implications of and public response to environmental contaminants.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	41.7			41.7
	Work Years:	1.0			1.0

Budget Source: RAC

KEYWORDS: psycho-social impacts, contaminant exposure

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Canadian Mental Health Association

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

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PROJECT TITLE: Determinants of Participation in Solid Waste Source Separation Program in Apartment Buildings      PROJECT NO: 366G  
START DATE: 11/87

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SHORT TITLE: Source Separation in Apartments

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PRINCIPAL INVESTIGATOR AND AFFILIATION:                      V.W. Maclaren  
University of Toronto

LIAISON OFFICER (name, location, telephone no.):      A. Ciulini  
Waste Management Branch  
323-5191

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OBJECTIVE(S): To discover the extent of source separation that exists in apartment buildings in a sample urban area to gain an understanding of why apartment building owners (or supervisors) decide to participate in a source separation program. The separated material may be returned to the waste stream by the building owner (or supervisor) or it may be recycled. To describe the operational characteristics of existing programs and identify the feasibility of developing source separation programs for buildings not yet having programs. To examine the determinants of resident participation in apartment building recycling programs.

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PROJECT DESCRIPTION: The first part of the proposed research will be an inventory of apartment buildings in a sample urban area (the City of Toronto) in order to determine the amount of source separation (with or without recycling of the source separated materials) that is currently being practised. The second part of the study examines participation rates among apartment building residents in existing recycling programs in Kitchener, Mississauga, Guelph, Oshawa and Toronto. Both studies will use questionnaire surveys, the first with a sample size of 700 and the second with a sample size of 800.

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BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	19.2				19.2
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Work Years:

Budget Source: RAC

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KEYWORDS: Recycling, solid waste, apartments, participation

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OUTPUT (papers, presentations, reports): Report

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EXTERNAL PARTICIPATION (ministries, governments, agencies): University of Toronto

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Improvements in Nutripel Pelleted  
Organic Fertilizer Technology

PROJECT NO: 367C  
START DATE:

SHORT TITLE: Organic Fertilizer Technology

PRINCIPAL INVESTIGATOR AND AFFILIATION:

G.B. Gray  
Can-Vert Waste Conversion  
Technologies

LIAISON OFFICER (name, location, telephone no.): N. Ahlberg

Waste Management Branch  
323-5189

OBJECTIVE(S): To achieve substantial improvements over the existing Swedish process for pelleted organic fertilizer from sewage sludge, through:

- 1) adaptation to permit utilization of diverse local sources of carbonaceous material;
- 2) integration of the composting step with the pelleting process;
- 3) elucidation of the mechanism of mobilization and uptake of heavy metals and destruction of hazardous organics in the process;
- 4) differentiation between various composting processes.

PROJECT DESCRIPTION: Research will be carried out on a laboratory-scale tunnel composter, a pilot-scale drum composter, and on the Ministry's Resource Recovery Center Downsview. Bench research will study the heavy metals and hazardous organics objectives. Evaluation of results will be by comparative assessment of the performance of the resulting pelleted organic fertilizer, through incubation/leaching, nitrification and nitrogen release studies, horticultural growth response tests, and process data, all with extensive analytical support.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	80.0				80.0
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Work Years:

Budget Source: RAC

KEYWORDS: nutripel, organic fertilizers, sewage sludge reuse, drum composter

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Development and Demonstration of Permanent On-Site Solutions for Hazardous Waste Site Rehabilitation and Restoration at an Organic Chemical Plant

PROJECT NO: 368G  
START DATE: 11/87

SHORT TITLE: Waste Site Rehabilitation, Elmira

PRINCIPAL INVESTIGATOR AND AFFILIATION: R.J. Rush  
Canviro Consultants

LIAISON OFFICER (name, location, telephone no.): M. Fielding  
Research & Technology Branch  
323-4576

OBJECTIVE(S): To research, develop and demonstrate permanent onsite remedial technologies for organic contamination of groundwater at waste disposal or industrial sites.

PROJECT DESCRIPTION: The major tasks of the study are as outlined below:

Phase 1 - R&D and Predesign of Selected Technologies for Documentation

Task 1 - Brief review and update of the hydrogeology at the Uniroyal Site, Elmira (Typifies organic contaminant sites in Canada)

Task 2 - Conduct lab and pilot studies of selected groundwater decontamination methods and contaminant mobility

Task 3 - Develop a hydrogeological model

Task 4 - Phase 1 Report - including design of technologies for development and demonstration in Phase 2

Phase 2 - Aquifer Rehabilitation Technology Development and Demonstration

Task 5 - On-site purge well test to provide data for an aquifer rehabilitation management model

Task 6 - Field Scale groundwater treatment development and demonstration (budget will allow for two selected technologies to be demonstrated)

Task 7 - Phase 2 Report - including management model for aquifer rehabilitation

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's): MOE	173.6	227.9			401.5
ENV.CAN	128.4	175.6	99.6		401.5
UNIROYAL			125.0		<u>125.0</u>
Work Years:					
Budget Source: RAC, ENV. CANADA, UNIROYAL					928.2

KEYWORDS: Waste Site, Hazwaste, Rehabilitation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):  
Federal Government, Industry

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: The Design and Evaluation of In Situ      PROJECT NO: 369G  
Biorestitution Methods for Treatment of Sludges and      START DATE: 10/87  
Soils at Waste Disposal Sites

SHORT TITLE: Landfill/Soil Biorestitution Methods

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. J.F. Barker  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): D.J. Cook  
Kingston District Office  
(613) 549-4000

OBJECTIVE(S): To develop and evaluate in situ measures for remediating organic  
contaminants in waste sludges.

PROJECT DESCRIPTION: Laboratory microcosm experiments will be conducted upon 6  
sludges from the MacDougall landfill site. These will define the microbial and  
geochemical conditions under which various target organic contaminants will  
biodegrade. Various nutrient and oxidant additions will be made to the  
laboratory experiments to assess the benefits of making minor in situ  
geochemical manipulations in order to enhance the rate of biotransformation of  
organics in the in situ microbial community.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	40.3			40.3
	Work Years:	0.91			0.91

Budget Source: RAC

KEYWORDS: sludges, waste disposal sites, biorestitution in situ

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Treatability/Leachability Study of  
MSW Incinerator Ash

PROJECT NO: 370C  
START DATE: 10/87

SHORT TITLE: Leachability Study/MSW Incinerator Ash

PRINCIPAL INVESTIGATOR AND AFFILIATION:

S. Sowell  
Waste Water Technology Centre  
CCIW

LIAISON OFFICER (name, location, telephone no.): W.B. Ng

Waste management Branch  
323-5128

OBJECTIVE(S): To increase the knowledge based on the leachability of organic and inorganic contaminants from municipal solid waste (MSW) incinerator ashes, to develop and evaluate treatment processes for rendering MSW fly ash acceptable for disposal and to recommend ash management practices suitable for inclusion into National Guidelines for MSW incineration.

PROJECT DESCRIPTION: The major components of the study are:

- to evaluate the use of SEM/EDS techniques to identify metal specification within ESP fly ash.
- to characterize the leachability of organic contaminants in fly ash from ESP and scrubber/FF pollution control devices (ESP - Electrostatic Precipitator; FF - Fabric Filter).
- to assess the effectiveness of selected solidification techniques in reducing the leachability of organic and inorganic contaminants from MSW ash residues.
- to determine the feasibility of recovering metals from MSW ash residues.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	60.0			60.0
	Work Years:	0.67			0.67

Budget Source: WMB

KEYWORDS: municipal solid waste, incinerator ash, inorganic and organic contaminants, leachability, solidification

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Environment Canada (\$60K).

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: A Study to Determine the Feasibility of Modelling Microclimatic Conditions on the Fonthill Kame (Phase I) PROJECT NO: 371G  
START DATE: 10/87

SHORT TITLE: Microclimate Conditions/Fonthill Kame

PRINCIPAL INVESTIGATOR AND AFFILIATION: Corwin Cambray  
Regional Municipality of  
Niagara

LIAISON OFFICER (name, location, telephone no.): D. Corr  
West Centre Region  
521-7705

OBJECTIVE(S):

1. To review existing physiographic and climatological information associated with fruit growing on the Fonthill Kame
2. To describe possible methodologies to model microclimatic conditions under existing topographic conditions and under modified terrain scenarios.
3. To recommend, in a final report, a preferred approach to modelling microclimate on the Kame if one exists.

PROJECT DESCRIPTION: The purpose of the initial study is to determine an appropriate methodology for modelling microclimatic conditions on the Fonthill Kame under existing topographic conditions and under modified terrain scenarios.

The preferred methodology chosen, when applied, will assist in determining whether or not major topographic changes (eg. sand and gravel extraction) on the Fonthill Kame will have a detrimental effect on the unique microclimate in the area and, thus, on tender fruit growing there.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	9.5				9.5
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Work Years:

Budget Source: RAC

KEYWORDS: microclimate, fonthill kame, model, topographic conditions, fruit trees

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC. Branch. etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Digital Image Analysis of Particles  
in a Turbulent Wind

PROJECT NO: 372G  
START DATE: 11/87

SHORT TITLE: Airborne Particulates/Image Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:

J.F. Keffer  
University of Toronto

LIAISON OFFICER (name, location, telephone no.):

G. Diamond  
Air Resources Branch  
965-4081

OBJECTIVE(S):

- To create a comprehensive data-base comprising particle-trajectory and turbulent wind statistics and to correlate these statistics via regression analysis.
- To develop and implement a random-flight Lagrangian model for predicting particle-trajectory statistics.

PROJECT DESCRIPTION:

- a wind-tunnel investigation of the turbulent-wind erosion of mono-dispersed and poly-dispersed particulate matter will be carried out for a wide variety of controlled profiles and surface conditions.
- a novel state-of-the-art flow-visualization/digital-image analysis technique will be used to determine particle-trajectory characteristics.
- Hot-wire anemometry and statistical signal-analysis methods will be used to determine the turbulent-wind characteristics.
- The particle-trajectory information will be correlated with the turbulent-wind statistics via multiple-regression analysis.
- An environmental Lagrangian particle-trajectory model will be developed and calibrated with measured particle-trajectory data.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	71.8	68.4		140.2
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Work Years:

Budget Source: RAC

KEYWORDS: digital image analysis, particle trajectory, turbulent wind statistics, wind tunnel, correlation, lagrangian model

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

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PROJECT TITLE: Development of Monitoring Methods for Odorous Organics in Ambient Air      PROJECT NO: 373C  
START DATE: 11/87

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SHORT TITLE: Ambient Air/Monitoring Methods

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Cecilia Chan  
Mann Testing Lab. Ltd.

LIAISON OFFICER (name, location, telephone no.): A. Szakolcai  
Air Resources Branch  
965-4081

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OBJECTIVE(S): To develop a complete sampling and analytical protocol for the low level determination and quantification of 4 classes of odourous compounds. The specific objects are:

- to review available analytical methods for the sampling and analysis of the odorous organics in ambient air;
- to assess possible problems associated with the application of these methods under actual field conditions;
- to design and develop a suitable sampling and analytical protocol for each class of odorous compounds;
- to thoroughly evaluate the methods under both laboratory and field conditions.

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PROJECT DESCRIPTION: To develop a unique method for each compound class that will give prompt results with a high degree of accuracy. A number of techniques will be investigated, including: in-situ derivatization on impregnated sorbents; adsorption/thermal desorption; collection and reaction with a reagent in an absorber; and other preconcentration techniques. The projects will be divided into 4 distinct phases, each pertaining to the development/evaluation of a specific class of compounds. The total time frame for each compound class will be about 6 months and a final report will be submitted to the MOE for review and approval.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		103.3	67.5		185.0
Work Years:					

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Budget Source: RAC

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KEYWORDS: ambient air, odourous, organics, sampling, analysis

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

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PROJECT TITLE: To Evaluate Beach Use Benefits Related to Water Quality Improvements PROJECT NO: 374C  
START DATE: 11/87

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SHORT TITLE: Water Quality/Beach Use Benefits

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PRINCIPAL INVESTIGATOR AND AFFILIATION: M. Fortin  
Ecologistics Limited

LIAISON OFFICER (name, location, telephone no.): L. Coplan  
Policy and Planning Branch  
323-4420

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OBJECTIVE(S): To develop an evaluation procedure to forecast potential benefits of proposed beach water quality rehabilitation measures. The study objectives are to:

- monitor beach use and beach attributes (including water quality) over time at several sites;
- complete a user survey;
- develop, verify and compare contingent valuation and travel cost models for beach recreation; and
- incorporate model results into a beach use planning tool to evaluate water quality improvements.

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PROJECT DESCRIPTION: The study will involve season-long (June to August) monitoring of environmental conditions and beach use as well as beach user surveys. Collected data will be used to estimate alternative beach-use valuation models (travel cost and contingent value) incorporating water quality. Model results will then be used to develop a planning tool for estimation of changes in beach use levels and associated benefits arising from water quality improvements.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	79.1			79.1
	Work Years:				

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Budget Source: RAC

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KEYWORDS: beach use model, water quality, user survey, benefit forecasting

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant	Unsolicited X

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PROJECT TITLE: Retractable Composite Absorbents for Environmental Clean-Up	PROJECT NO: 375C START DATE: 03/88
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SHORT TITLE: Toxic Materials Removal/Composite Absorbents

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	A.E. Redpath Ecoplastics Limited
LIAISON OFFICER (name, location, telephone no.):	O. Meresz Laboratory Services Branch 235-5762

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OBJECTIVE(S): The clean up of chemically contaminated creek, river bed and lake bottom sediments is a problem of increasing importance. This one year program is intended to develop to field study stage the novel retractable composite adsorbent (RCA) technology demonstrated in the earlier study. It is intended to a) test the technology under simulated field conditions, b) define working product specifications, c) establish a pilot scale production facility and d) evaluate commercial scale quantities at actual contaminated field sites.

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PROJECT DESCRIPTION: The project will have essentially four tasks, consistent with the four specific objectives given above. Working with MOE and industry personnel, the characteristics of target contaminated sites will be defined and a simulation chamber prepared. The RCA's will be evaluated in the test chamber; the results of these tests in combination with practical field application factors will set product specifications. A pilot scale production line will be established, utilizing existing polymer processing shops insofar as possible. The test product will then be evaluated at one or more field locations.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	152.6			152.6
	Work Years:				

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Budget Source: RAC

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KEYWORDS: environmental clean-up, spill containment, retractable absorbents

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OUTPUT (papers, presentations, reports): Results will be reported after patent protection is secured.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Solid Phase Extraction of PAH's from Drinking Water and Analysis of Chlorophenols and Phenoxy-acid Herbicides in Water

PROJECT NO: 376G  
START DATE: 11/87

SHORT TITLE: Drinking Water/Hydrocarbon Removal

PRINCIPAL INVESTIGATOR AND AFFILIATION: B. Craig  
Paracel Laboratories Ltd.

LIAISON OFFICER (name, location, telephone no.): D. Hall  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): To determine the feasibility of using Solid Phase Extraction (SPE) in the analysis of polynuclear aromatic hydrocarbons (PAH's) in water.

To complete the work conducted previously as a feasibility study on the solid phase extraction of chlorophenols and phenoxy-acids so that this methodology may be adopted as a routine procedure by the Ministry and to improve the derivatization and clean-up procedures for these compounds.

PROJECT DESCRIPTION: The feasibility study of solid phase extraction of PAH's will include:

- an in-depth critical review of the literature;
- selection of the best solid phase;
- selection of the best supplier;
- determination of the stability of lots;
- investigation of methods to reduce interferences;
- determination of recoveries;
- application to real samples; and
- determination of the stability of adsorbates.

The project on analysis of chlorophenols and phenoxy-acid herbicides involves fine-tuning the existing methodology for the solid phase extraction of chlorophenols and phenoxy-acid herbicides from water. This work will decrease the levels of interferences in these samples and examine the parameters that affect the reproducibility and accuracy of the methodology. Also, a variety of derivitization procedures for the characterization of these compounds will be studied.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	100.0			100.0
	Work Years:				

Budget Source: RAC

KEYWORDS: solid phase extraction, water, polynuclear aromatic hydrocarbons (PAH's), chlorophenols, phenoxy-acid herbicides, method optimization

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Applications of Gas Phase Ion Chemistry PROJECT NO: 377G  
to Problems in the Chemical Ionization Mass START DATE: 10/87  
Spectrometric Analysis of Trace Organics

SHORT TITLE: Trace Organics/Mass Spect. Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. T.B. McMahon  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): E.J. Reiner

Laboratory Services Branch  
235-5903

OBJECTIVE(S) :

- To investigate ion-molecule reactions of potential CI reagent ions with compounds of environmental interest
- To develop new more sensitive, selective CI methods.

PROJECT DESCRIPTION: A general survey of gas phase ion molecule reactions involving trace organic chemicals present as environmental contaminants will be conducted. Potential CI methods will be devised and tested.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	45.0	45.0
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Work Years:	2.1	2.1
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Budget Source: RAC

KEYWORDS: gas phase ion chemistry, mass spectrometric analysis, trace organics

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant	Unsolicited X

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PROJECT TITLE: Robustness of the Student's T-Test with Censored Environmental Quality Data	PROJECT NO: 378C START DATE: 11/87
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SHORT TITLE: Water Quality/Student's T-Test

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Edward Creese Ted Creese, Independent Consultant
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LIAISON OFFICER (name, location, telephone no.):	S. Davies Laboratory Services Branch 235-5894
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OBJECTIVE(S): To investigate the applicability of a standard statistical test to data sets where some observations are below a detection limit.

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PROJECT DESCRIPTION: Objectives will be met by a computer simulation study on data simulated to have the desired characteristics. This study, if approved, will be of benefit whenever it is desired to compare two sets of water quality data to find out, for example, if one area is more contaminated than another or if contamination in an area has increased over what it was the previous month. Presently the T-Test can be applied to such situations, but if one or both data sets is censored, then the confidence levels given by the test are almost certainly too high. The presently proposed study will find probability levels that are consistent with the censored nature of the data.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	1.9	9.6		11.5

Work Years:

Budget Source: RAC

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KEYWORDS:

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of an Optimum System for the Application and Regeneration of Powdered Activated Carbon in Water Treatment Plants  
PROJECT NO: 379C  
START DATE: 11/87

SHORT TITLE: Water Treatment/Powdered Activated Carbon

PRINCIPAL INVESTIGATOR AND AFFILIATION: A. Benedek  
Zenon Environmental Inc.

LIAISON OFFICER (name, location, telephone no.): J. Dart  
Water Resources Branch  
323-4876

OBJECTIVE(S):

- 1) To develop process design criteria for application of powdered activated carbon (PAC) in drinking water treatment for the removal of toxic organic contaminants.
- 2) To develop an optimized PAC contacting system, and carry out field tests.
- 3) To develop a conceptual plan for Southwestern Ontario water plants for the application and assess the potential of regenerating PAC in an environmentally acceptable and convenient mode of operation.

PROJECT DESCRIPTION: The proposed two-phase study will develop process design criteria for removal of toxic organic contaminants from drinking water, by application and regeneration of PAC. Laboratory bench-scale studies will be implemented to identify and optimize the most promising system and a pilot-scale study will be carried out utilizing the developed process. Based on these results, design criteria, a technical and economic assessment, as well as an approach to implementation in Southwestern Ontario will be developed.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	186.9	183.1		370.0
	Work Years:				

Budget Source:

KEYWORDS: powdered activated charcoal, toxic organics removal, drinking water, field tests, regeneration, conceptual planning

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Regeneration aspects de-emphasized except for stressing floc-free carbon separation suitable for regeneration.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: A Preliminary Study to Determine the Feasibility of Medium Pressure Mercury Lamps for Disinfecting Low Quality Wastewaters

PROJECT NO: 380C  
START DATE: 12/87

SHORT TITLE: Wastewater Disinfection/Mercury Lamps

PRINCIPAL INVESTIGATOR AND AFFILIATION:

G.E. Whitby  
Trojan Technologies Ltd.

LIAISON OFFICER (name, location, telephone no.):

F. Engler  
Water Resources Branch  
235-5821

OBJECTIVE(S): A preliminary study to determine the feasibility of medium pressure mercury lamps for disinfecting low quality wastewaters.

PROJECT DESCRIPTION: This study will take 8 months and will compare medium and low pressure mercury lamps using a collimated beam method. The wastewaters will be chemically and physically characterized. The effect of turbulence on disinfection will be investigated.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
Cost: (\$000's):		15.4	37.9		53.3
Work Years:					

Budget Source: RAC

KEYWORDS: disinfection, ultraviolet (UV) light, medium pressure mercury lamps, low quality wastewater, storm water, combined sewer overflow (CSO)

OUTPUT (papers, presentations, reports): RAC report, Technology Transfer Conference presentation.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Draft report received end of September, 1988.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Recent Trends and Historical Changes in Water Quality of Lake Muskoka  
PROJECT NO: 381C  
START DATE: 11/87

SHORT TITLE: Water Quality/Historical Changes, Lake Muskoka

PRINCIPAL INVESTIGATOR AND AFFILIATION: Mariusz Rybak  
Aquatic Research &  
Ecological Consultants

LIAISON OFFICER (name, location, telephone no.): K. Nicholls  
Water Resources Branch  
235-5810

OBJECTIVE(S): To analyze and document long-term changes in Lake Muskoka with emphasis on heavy metals contamination and eutrophication processes.

To provide an overall assessment of the direction, timing and character of environmental changes in the lake.

PROJECT DESCRIPTION: The research will be carried out on Lake Muskoka, Ontario. Spatial variation of heavy metals contamination, nutrient enrichment as well as primary production will be documented on the basis of preliminary investigation. This will provide a necessary documentation for paleoecological reconstruction. During the second part of the project detailed biostratigraphic and geochemical analysis will be performed. This will allow the investigator to establish paleoecological reconstruction and historical changes of water quality in Lake Muskoka. Documented changes in water quality will be interpreted against the past and present shoreline development as well as the disturbance history of lake watersheds.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's):	7.4	32.3		39.7
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Work Years:

Budget Source: RAC

KEYWORDS: Lake Muskoka, water quality, paleoecological reconstruction, historical changes, storeline development, disturbance history

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: The Carbon and Sulfur Cycle in Shallow, PROJECT NO: 382G  
Unconfined Aquifer Systems START DATE: 11/87

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SHORT TITLE: Groundwater/Carbon and Sulfur Cycle

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PRINCIPAL INVESTIGATOR AND AFFILIATION: R.W. Gillham  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): W. Blackport  
West Central Region  
521-7703

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OBJECTIVE(S): To gain a better insight into the role of organic carbon, both dissolved and solid, in redox processes that occur in shallow groundwater systems. The role and fluxes of carbon in two shallow unconfined aquifer systems near Alliston and Rodney will be assessed in light of sulfate reduction and denitrification processes that occur.

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PROJECT DESCRIPTION: Groundwater monitoring equipment will be installed in two unconfined sandy aquifers. Stratigraphy and soil profiles will be interpreted from coring of the aquifers. Comprehensive geochemical and isotopic sampling of the groundwater will be performed over one year to assess seasonal variations in recharge, fluxes of sulfur and carbon, and water chemistry.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	37.4	31.1		68.5

Work Years:

Budget Source: RAC

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KEYWORDS: shallow groundwater system, carbon and sulphur cycle, redox processes

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: The Origin and Distribution of Methane in the Alliston Sand Aquifer PROJECT NO: 383G  
START DATE: 11/87

SHORT TITLE: Groundwater/Alliston Sand Aquifer

PRINCIPAL INVESTIGATOR AND AFFILIATION: J.F. Barker  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): W. Blackport  
West Central Region  
521-7703

OBJECTIVE(S): To identify both the origin of methane in the Alliston sand aquifer and the geochemical and hydrogeological factors controlling its distribution.

PROJECT DESCRIPTION: Existing data will be reviewed and additional groundwaters will be collected. These will be analyzed for the distribution of carbon between the organic, inorganic and methane components and for the carbon and hydrogen isotope distributions. The mode of origin of the methane will be interpreted and the factors controlling the distribution of methane will be identified. If possible, management practices will be identified which could minimize the current water quality problems caused by methane in the Alliston and other aquifers.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	29.4	33.8		63.2

Work Years:

Budget Source: RAC

KEYWORDS: methane, groundwater, origin, distribution controlling factors

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Development of a Centralized  
Information System on Acid Generation Management  
Experience in British Columbia

PROJECT NO: 385C  
START DATE: 11/87

SHORT TITLE: Acid Generation Management/Info System

PRINCIPAL INVESTIGATOR AND AFFILIATION: John O'Riordan  
MOE (BC)

LIAISON OFFICER (name, location, telephone no.): J. Hawley  
Water Resources Branch  
323-2670

OBJECTIVE(S):

1. To collect and organize existing information relative to acid generation management in British Columbia.
2. To assess the feasibility of establishing a centralized acid generation information system accessible to industry consultants and government agencies.

PROJECT DESCRIPTION: The Acid Mine Drainage Task Force expects to accomplish two main projects:

- 1) To consolidate existing information relative to acid generation management in the province.
- 2) To develop a long-term study program that identifies and prioritizes opportunities for future research on acid generation management.

It is the first of these two tasks that funding assistance was requested from CCREM.

Funds will be used to hire a contractor to analyse the results and summarize them in a report. As there are thousands of acres of acid tailings on the ground in Ontario at present; this B.C. research has special merit for Ontario.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	15.0				15.0
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Work Years:

Budget Source: RAc

KEYWORDS: acid generation management, B.C., data collection centralized information system

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): MOE(BC) 5.0K, MEMPR 5.0K, EPS (VAWC) 4.0K, BC Mining Assoc.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Hamilton Air: Chemical Composition  
and Genotoxic Activity of Respirable Particulate  
and Organic Vapours

PROJECT NO: 386G  
START DATE: 01/88

SHORT TITLE: Air Quality/Hamilton

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. D. Macalla  
McMaster University

LIAISON OFFICER (name, location, telephone no.): D. Corr

West Central Region  
521-7705

OBJECTIVE(S): Determine what levels of airborne mutagenicity can be detected on respirable particles in the Hamilton airshed as a function of season and meteorological conditions. Determine if a simple mammalian index of genotoxic hazard can be developed using a post labelling technique which permits the quantitation of DNA adducts formed with activated carcinogens. Determine what chemical classes contribute to the mutagenicity of Hamilton air. Determine how total airborne mutagenicity related to the air quality index.

PROJECT DESCRIPTION: Preparation of reference sample by extraction of air particulate samples collected by D. Pengelly, et al. Fractionation of reference sample and characterization of fractions for mutagenicity in the Ames/Salmonella assay. Testing of mutagenic PAH fractions for DNA adduct formation using the <sup>32</sup>P-postlabelling assay with bacteria and/or rabbit tracheal cells. Chromatographic analysis of PAH fractions derived from reference sample. Designation of tracers for source apportionment. Initial collections of respirable air particulate samples from three locations in Hamilton.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	130.0			130.0
	Work Years:	2.8			2.8

Budget Source: RAC

KEYWORDS: airborne mutagenicity, respirable particles, air quality index, AMEs test, rabbit tracheal cells

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Partial Support of a Collection of                      PROJECT NO: 387G  
Algal, Microbial and Plant Cell Cultures                      START DATE: 02/88

SHORT TITLE: Algal, Microbial and Plant Cell

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      P. Stokes  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): K. Nicholls  
Water Resources Branch  
235-5810

OBJECTIVE(S): To develop and maintain a research collection of microorganisms (algae, cyanobacteria, selected bacteria) and higher plant cells which will be used extensively in research on environmental science, environmental engineering, algal physiology and ecology and plant biotechnology (including algae and higher plants). To provide a resource centre for plasmid vectors and plasmid-borne clone banks constructed from photosynthetic organisms and gene-specific cloned DNA to be used as probes. To create and implement an information network for researchers to provide computer access to this collection and link with other culture collections.

PROJECT DESCRIPTION: The University of Toronto Culture Collection is a facility of the Institute for Environmental Studies and the Department of Botany and was initiated in late 1986 with a one-year grant from the Ontario Ministry of Colleges and Universities Excellence Fund. At present, about 150 isolates of algae and cyanobacteria are being cultured, including 30 isolates from acidified, organically or metal polluted waters. We anticipate that at full capacity the UTCC will be maintaining about 1000 isolates. As far as possible the cultures will be maintained in axenic condition and in defined media, as is required for most research applications. The Ministry of the Environment will have access to this culture collection.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
Cost: (\$000's):		12.0	12.0	12.0	36.0
Work Years:					

Budget Source: RAC

KEYWORDS: culture collection, algae, cyanobacteria, bacteria, higher plant cells, plasmids, environmental research, ENA probes

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited X
INTERNAL	Grant	Unsolicited

PROJECT TITLE: Sampling of Biomedical Waste Incinerators	PROJECT NO: 388C START DATE: 02/88
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SHORT TITLE: Waste Incineration/Biomedical Waste Incinerators

PRINCIPAL INVESTIGATOR AND AFFILIATION: Shekar Viswanathan  
Clayton Environmental Consultants

LIAISON OFFICER (name, location, telephone no.): V. Ozvacic  
Air Resources Branch  
965-5776

OBJECTIVE(S): Perform stack sampling at ten biomedical waste incinerators. Using separate sampling trains, collect stack samples for the following analyses: a) particulates, trace metals and hydrogen chloride, b) trace organic species - PAHs, PCDDs, PCDFs, PCBs, chlorobenzenes, and chlorophenols, c) volatile organic species such as chloroform, benzene ethylene chloride, d) bacteria, spores and viruses. Record quantities and classifications of wastes and observe incinerator operations during sampling. Weight the ash residue after each batch incineration and prepare a representative sample of this ash for chemical and other analyses and a leachate study. Transport all samples to the Ministry's laboratories. Provide a comprehensive report after completion of this study (including two preliminary reports).

PROJECT DESCRIPTION: The compounds of interest will be determined by employing techniques consistent with the following documents:  
A method of Measure Emissions of Particulate Matter, Metals and Hydrogen Chloride from Stationary Sources, Environmental Protection service (April, 1985).

ASME Protocol Sampling for the Determination of PCDDs, PCDFs, PAHs, PCBs, Chlorobenzenes, and Chlorophenols.

Protocol for the collection and analysis of Volatile POHCs using VOST - EPA report 600-8-84-007, (March, 1984).

Method 5 Stack Sampling Program for the Determination of Bacteria, Spores and Viruses. In addition, the incinerator operations will be recorded during each sampling period. A preliminary test will be carried out to obtain data for nozzle sizing and derivation of isokinetic sampling parameters. A total of three tests will be conducted on each site for compounds of interest under normal operating conditions.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	150.0	250.0		400.0

Work Years:

Budget Source: ARB/RAC

KEYWORDS:

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Funding Schedule FY 87/88 \$150,000 ARB  
FY 88/89 \$250,000 RAC

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Modelling Higher Moments of the  
Concentration Probability Distribution  
(Concentration Fluctuations)

PROJECT NO: 389C  
START DATE: 02/88

SHORT TITLE: Concentration Fluctuations/Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION:

E. Alp  
Concord Scientific Corp.

LIAISON OFFICER (name, location, telephone no.):

P.K. Misra  
Air Resources Branch  
235-5721

OBJECTIVE(S): Development of a state-of-the-art model for estimating  
concentration fluctuation (second moment) compatible with the proposed mean  
concentration models in Regulation 308.

PROJECT DESCRIPTION: Comprehensive literature review of available models and  
data, implementation of (a) selected model(s) and testing against data;  
fundamental development work for enhancing the capabilities of the model,  
investigation of incorporation into the regulatory framework, implementation  
of model with the proposed Regulation 308 models.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	92.2	108.2	46.7	247.1
	Work Years:				

Budget Source: RAC

KEYWORDS: concentration, fluctuation, fundamental, framework, implementation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Mutagenicity Studies and Risk  
Estimation of Complex Mixtures of Organic Airborne  
Contaminants

PROJECT NO: 390G  
START DATE: 01/88

SHORT TITLE: Mutagenicity/Risk Estimation

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. D.M. Logan  
York University

LIAISON OFFICER (name, location, telephone no.): M. Salamone

Water Resources Branch  
235-5790

OBJECTIVE(S): Test nine airborne mutagens in four mutagenicity assays. Measure toxicity singly and mutagenicity both singly and in defined combinations. Using these data, to develop a process by which one can predict the biological response to complex atmospheric mixtures of pollutants.

PROJECT DESCRIPTION: Pure samples of the 9 individual compounds will be tested for toxicity and classified regarding mutagenic potency into four categories, inactive, weakly active, moderately and strongly mutagenic. Synergistic or inhibitory effects will be determined on a range of pairwise combinations of pollutants representing the three different groups, ie., PAHs promutagens, nitro-PAHs and halogenated hydrocarbons. The first year will use primarily the Ames and micronucleus assays.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	100.0			100.0
	Work Years:	2.23			2.23

Budget Source: RAC

KEYWORDS: airborne mutagens, toxicity, biological response, risk estimation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: ACPOP - Aqueous Organic Pollutant Mineralizer	PROJECT NO: 391C
	START DATE: 05/88

SHORT TITLE: Aqueous Organic Pollutant Mineralizer

PRINCIPAL INVESTIGATOR AND AFFILIATION:	M. Robertson Nutech Energy Systems Inc.
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LIAISON OFFICER (name, location, telephone no.):	O. Meresz Laboratory Services Branch 235-5762
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OBJECTIVE(S): Prime objective is to produce a fixed anatase mineralizer capable of treating solutions with 10 ppm organics with a destruction efficiency of 95% at an operating cost of 0.04¢/litre.

Secondary objectives are to generate a systematic body of chemical and engineering data needed to develop the mineralizer, develop an anatase coating with a specific area of 50m<sup>2</sup>/gm, develop an anatase coating with high affinity for organic molecules in the absence of light, to further identify market niches for the mineralizer, and to evaluate the economics of different mineralizer applications.

PROJECT DESCRIPTION: Present technologies for the removal of low level organics from water are unable to destroy stable organic pollutants. However, Nutech's ACPOP mineralizer is able to convert organics to carbon dioxide and water. To accomplish this, contaminated water is passed through a support matrix to which photoactive titanium dioxide (anatase) has been covalently bonded. The matrix is simultaneously exposed to ultraviolet light in the range of 340-370 nm.

This process, which has been successful in bench-scale testing of the prototype, represents an exciting breakthrough in destruction of organics in a variety of matrices, and has a number of practical applications if it proves to be successful in the pilot scale study.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	300.0	50.0		350.0
	Work Years:				

Budget Source: RAC

KEYWORDS: photochemical mineralization, trace organics, destruction indilute aqueous solutions

OUTPUT (papers, presentations, reports): Presentation at the MOE Technology Transfer Conference 1988.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Co-Funded by NRC-IRAP program, Funding \$655,000

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: A Study of Geochemical Modification of Groundwater Discharging Into Surface Waters From an Industrial Disposal Site      PROJECT NO: 392G  
START DATE: 04/88

SHORT TITLE: Groundwater/Industrial Disposal Site

PRINCIPAL INVESTIGATOR AND AFFILIATION:      D.R. Lee  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): W. Wager  
Sarnia Regional Office  
(519) 336-4030

OBJECTIVE(S): The first objective is to determine changes in major ion chemistry during groundwater discharge at a major offshore discharge area in the St. Mary's River near a slag disposal site.

The long-term objective is to develop and exercise new methods for assessing the impact of offshore contaminant plumes by providing quantitative data on solute transport and model predictions for a range of geochemical conditions in discharge zones.

PROJECT DESCRIPTION: The proposed work is a study of groundwater as a source of non-point pollution to surface water. It is now possible to locate offshore zones of groundwater and contaminant discharge using a weighted probe containing temperature and electrical conductance sensors. The probe has been used successfully at both Cape Cod and Sault Ste. Marie. Thus, for the first time it is possible to quantify the geochemical changes that occur during the final metres of groundwater flow into surface waters. At the proposed study site the groundwater has been massively modified by leachate from an adjacent slag dump. Qualitative observation and chemical theory both support the fact that large chemical changes will occur in groundwater discharge environments. However, there has been little quantitative work in this subject. The topic is pertinent because without consideration of this geochemical interface it will not be possible to predict solute fluxes from zones of onshore groundwater contamination to contiguous surface waters.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		16.8	12.3		29.1
Work Years:					

Budget Source: RAC

KEYWORDS: geochemical, contaminant plumes, conductance, leachates, fluxes

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Measuring Groundwater Velocity and Hydrodynamic Dispersion in a Single Fracture in Fractured Shale

PROJECT NO: 393G  
START DATE: 04/88

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SHORT TITLE: Groundwater/Hydrodynamics, Shale

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PRINCIPAL INVESTIGATOR AND AFFILIATION: J.A. Cherry  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): M. Goodwin  
Waste Management Branch  
323-5217

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OBJECTIVE(S): To investigate the relation between the fracture aperture width, 2b, determined from hydraulic tests and tracer experiments, and compare to the true aperture. Develop different field measurement techniques and evaluate for accuracy in predicting groundwater velocity. Determine the relation between the aperture density distribution and hydrodynamic dispersion. To determine whether a stochastic approach will be required to account for macroscopic hydrodynamic dispersion at the local field scale.

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PROJECT DESCRIPTION: The University of Waterloo, in a study funded by the Ontario Ministry of the Environment, has located and characterized a high-permeability fracture zone in a low-permeability fractured shale. High-permeability zones such as these are common near ground surface in the shales of southern Ontario and can provide important pathways for contaminant migration. Recent evidence from the University of Waterloo study and other work has suggested that there is considerable uncertainty in the accuracy of predictions of groundwater velocity along such fracture planes. To investigate this, the University proposes to characterize the fracture zone at the Waterloo study site in considerably more detail and with a view to developing new hydraulic and tracer testing techniques for more accurately determining the parameters necessary for predicting groundwater velocity. To assess the newly developed and existing techniques, velocity predictions based on the results of the site characterization will be compared to the results of a natural gradient tracer experiment in which the actual groundwater velocity will be measured. In addition, physical inspection of the fracture plane surfaces will be undertaken to aid in the comparison of results. As a result of the findings, the University hopes to provide recommendations or guidelines for the use of hydraulic testing techniques in fractured shale.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	40.0	40.0	40.0	120.0

Work Years:

Budget Source: RAC

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KEYWORDS: groundwater velocity, fracture planes, improved measurement, prediction

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Fish Waste Production - Rainbow Trout      PROJECT NO: 394G  
Culture    START DATE: 04/88

SHORT TITLE: Fish Waste Production

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      P.S. Chisholm  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): A. McLarty  
West-Central Region  
521-7640

OBJECTIVE(S):

Year 1: To develop a preliminary model to estimate waste production from rainbow trout culture facilities, in relation to fish growth.

Year 2: Test the preliminary waste production model based upon sampling of wastes produced by actual fish populations at selected growth stages.

PROJECT DESCRIPTION: Waste production from rainbow trout culture will be modelled for a range in fish mass 2 grams (initial mass) < mass (t) < 350 grams (finished mass). Modelling will be based upon fish growth in relation to temperature, corresponding intake of feed of known composition, related digestibility and excretion ratios. Dissolved, suspended and settled waste streams will be modelled and described in terms of concentration of settleable and suspended solids, settleable and suspended phosphorus, dissolved phosphorus, settleable and suspended nitrogen, dissolved nitrogen, ammonia. Nitrogenous and carbonaceous oxygen demands will be estimated for dissolved, suspended and settled waste streams. Model estimates, related fish growth, feed conversion, digestibility and excretion parameters will be tested in relation to measured waste production from fish samples maintained in an experimental environment representative of a well managed fish rearing operation. Waste production at four fish growth stages will be monitored in dissolved suspended and settled waste streams. Reconciliation of modelled and measured waste streams will be based upon independent results reported in the literature and known ranges in the waste production parameters incorporated in the model.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	11.4	11.5		22.9
	Work Years:				

Budget Source: RAC

KEYWORDS:

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: A Study of the Partitioning of Organic Chemicals in Aquatic Systems	PROJECT NO: 395G START DATE: 04/88
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SHORT TITLE: Methods Organic Chemicals/Partitioning

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PRINCIPAL INVESTIGATOR AND AFFILIATION: D. MacKay  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): W. Berg  
Laboratory Services Branch  
235-5907

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OBJECTIVE(S): To measure and interpret data on the sorption partition coefficients of a number of organic chemicals of varying hydrophobicity to a number of sorbing organic matrices, including alcohols, fulvic and humic acids. From the data obtained, it is hoped that procedures may be developed by which the extent of binding, sorption, or interaction of these chemicals to these phases may be ascertained. This information is important in studies or assessments of water column processes such as volatilization, bioaccumulation, and sedimentation, and is regarded as a key requirement for any water quality assessment involving these chemicals.

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PROJECT DESCRIPTION: It is proposed to study the extent to which hydrophobic organic chemicals interact with dissolved and particulate organic matter in water. This will be done by head space analyses of the air phase in equilibrium with aqueous solutions of chemicals, such as chlorobenzenes and polychlorinated biphenyls, thus unequivocally determining the truly dissolved concentration. This avoids the problems of separation by filtration or centrifuging. Measurements will also be made of the aqueous solubility enhancement induced by organic co-solvents, such as alcohols, fulvic and humic acids. In total, the project will contribute to an improved understanding of the extent to which organic chemicals are sorbed in water and thus become more available to processes such as sedimentation, and less available to processes such as volatilization. It is also hoped to develop an analytical procedure or protocol which can discriminate between the various types of organic carbon present in the water column with a view to determining their efficiency as sorbing agents.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	23.0			23.0

Work Years:

Budget Source: RAC

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KEYWORDS: water, organics, sorption, partition, head space analysis

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OUTPUT (papers, presentations, reports): Master's thesis, scientific paper(s)

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: Work involves Master's degree, under the direction of Professor Mackay.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Tillage and Event Based Soil and Phosphorus Loss                      PROJECT NO: 396G  
START DATE: 04/88

SHORT TITLE: Soil/Tillage Systems

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      R. Kachanoski  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. Draper  
Water Resources Branch  
323-4988

OBJECTIVE(S): To determine the effect of tillage systems (conventional, minimum, no-till) on phosphorus/soil loss and associated enrichment ratios for three representative soils (sandy, silt and clay loam). To determine seasonal variation in phosphorus and soil losses on different landscape positions with simulated rainfall. To determine annual phosphorus and soil losses from soil landscapes for natural precipitation events. To establish linkages between plot scale and landscape scale phosphorus and soil loss data for different tillage systems.

PROJECT DESCRIPTION: A study is proposed to obtain information on the seasonal variation of sediment and phosphorus loss for different tillages, landscape positions, and soil type combinations using rainfall simulation and natural precipitation events. The project will make use of existing tillage treatments and soil information being collected in the provincial Tillage-2000 program. Three tillage systems (conventional, minimum, and no-till) will be monitored on sand, silt, and clay loam soils. Two rainfall intensities will be simulated. The project will compare seasonal changes in sediment and P loss data from the microplots to an average annual value being estimated for the sites using cesium-137 as a natural tracer. The study will establish linkages between plot scale and landscape scale phosphorus and sediment loss data which can be used in an event based sediment transport model.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	67.5	67.5	67.5	202.5
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Work Years:

Budget Source: RAC

KEYWORDS: tillage systems, landscape positions, precipitation, phosphorus/soil loss

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Use of Pisidiidae Clams for Monitoring Toxicity of Contaminated Sediments      PROJECT NO: 397G  
START DATE: 04/88

SHORT TITLE: Toxicity Monitoring/Pisidiidae Clams

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      G. Mackie  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. Poirier  
Water Resources Branch  
235-5795

OBJECTIVE(S): To establish protocols for maintaining and culturing different species of Pisidiidae bivalves in the laboratory and to determine if pisidiids are suitable test organisms for assessing the acute toxicity of contaminated sediments.

PROJECT DESCRIPTION: A one-year study is described to determine if Pisidiidae clams are suitable test organisms for assessing the toxicity of contaminated sediments. Protocols for maintaining and culturing three species of pisidiids in the laboratory and for use of pisidiids in acute toxicity tests of contaminated sediments will be established in the first year of study.

If the pisidiids prove to be ideal indicators and bioassay organisms for contaminated sediments, application will be made for an additional two years of funding to establish protocols for use of pisidiids in sublethal tests for the assessment of the sublethal effects of contaminated sediments. Because pisidiids are hermaphroditic, ovoviviparous and capable of self-fertilization, they are unrivaled in their use as bioassay organisms for examining the sublethal and chronic effects of toxic materials on growth and reproductive processes of sediment-dwelling organisms.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	28.6			28.6
	Work Years:				

Budget Source: RAC

KEYWORDS: Pisidiidae, clams, acute toxicity test, contaminated sediments, culturing.

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: A Survey to Investigate the Frequency of Filamentous Algal Mats in Ontario Shield Lakes in the Context of Their Relationship with the Absence of Macro-Faunal Grazers

PROJECT NO: 398G  
START DATE: 04/88

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SHORT TITLE: Algal Mats, Ontario Shield Lakes

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Pamela Stokes  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): M. Jackson  
Water Resources Branch  
235-5812

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OBJECTIVE(S): To quantify metaphytic algal biomass within selected central Ontario Lakes. To forward an explanation for algal accumulation and persistence in such lakes based on whether a complementarity exists with respect to the abundance of macro-grazers.

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PROJECT DESCRIPTION: The university plans to sample up to 30 lakes during July and August 1988 to provide a broader framework from which to assess the results from their detailed research currently funded by MOE. Biological data to be collected include (a) metaphytic algal biomass, and (b) population densities of crayfish, tadpoles and cyprinids.

An empirical understanding of the complementarity of macro-grazers and filamentous algal biomass would allow predictions to be made regarding the susceptibility of acid-sensitive Shield lakes to nuisance "blooms" of these algae. Once such a relationship has been established, the potential for future design of grazer biomanipulations as a control to retard metaphyton development could be examined.

In an MOE funded survey of cottagers, aggregations of algae were identified as one of the chief concerns related to general water quality. Particularly, these effects were perceived to be a reduced enjoyment of swimming activity, reduced fish spawning, human health worries, and adverse effects on tourism and real estate values. Any further understanding of what determines metaphytic algal development will aid in identifying approaches to mitigate this phenomenon.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	17.5			17.5
	Work Years:				

Budget Source: RAC

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KEYWORDS: algal mats, shield lakes, macro-found grazers

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Validation of Spottail Shiner Daily Otolith Rings	PROJECT NO: 399G
	START DATE: 04/88

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SHORT TITLE: Spottail Otolith Rings

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PRINCIPAL INVESTIGATOR AND AFFILIATION: P. Powles  
Trent University

LIAISON OFFICER (name, location, telephone no.): K. Suns  
Water Resources Branch  
235-5798

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OBJECTIVE(S): To develop and validate an accurate and reliable method of ageing post larval (young-of-year) spottail shiners by count of the daily otolith rings.

To apply this method in future studies relating to contaminant surveillance, to ascertain age, (in days) and to confirm status as young-of-year.

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PROJECT DESCRIPTION: A field project covering the months of May, June, July, 1988 is planned to collect eggs, larvae, and post larvae of spottail shiner (*Notropis hudsonius*). Eggs will be reared in the lab, and samples for otoliths removed and preserved for later examination. Wild samples will also be captured from Rice Lake, and the otoliths analysed for daily rings. From these two approaches, an assessment and validation (or reliability) will be made of daily ring formation on the otoliths. These studies will enable us to tell precisely, the age of spottail shiners used in contaminant surveillance studies of the Great Lakes region, and to ensure that young-of-year fish are always selected for such studies.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	7.5				7.5
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Work Years:

Budget Source: RAC

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KEYWORDS: spottail shiner, otolith rings, ageing method, contamination surveillance

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: An Integral Model Study of the Airborne PROJECT NO: 400G  
Chemical Contaminants from Chemical Plants and Research START DATE: 04/88  
Buildings: Their Detection, Identification and a  
Proposed Method for Their Elimination

SHORT TITLE: Airborne Contaminants/Model Study

PRINCIPAL INVESTIGATOR AND AFFILIATION: C. Depew  
Queen's University

LIAISON OFFICER (name, location, telephone no.): R. Chapman  
Air Resources Branch  
965-4081

OBJECTIVE(S): To establish an integral model on a total study of some  
airborne contaminants originated from typical chemical plants and laboratories  
in Ontario. The model will select two typical classes of air pollutants:  
nitrogen oxides (inorganics) and substituted aromatic and polyaromatic  
hydrocarbons (organic). The overall model study involves the establishment of  
sampling and detection procedures, and the development of a new method for the  
elimination of the contaminants from air.

PROJECT DESCRIPTION: Document and review of existing sampling/detection  
technologies; defining procedures for air sampling from the exhaust air  
originating from the Queen's University research buildings. Experimental  
set-up of a time-averaged dual laser-fluorescence spectrometrical measurement  
technique for simultaneous measurement of nitrogen oxides and selected  
polyaromatic and substituted aromatic hydrocarbons. Proposal and design of a  
microwave-filtering device/technique for the removal/elimination of airborne  
contaminants from air samples collected and defined by previous studies.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	33.1	33.1	37.8	104.0
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Work Years:

Budget Source: RAC

KEYWORDS: chemical buildings, airborne contaminants, air filters, microwave  
catalyzed destruction

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Atmospheric Measurements of Natural Hydrocarbons Using Gas Chromatograph/Mass Spectrometry      PROJECT NO: 401G  
START DATE: 04/88

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SHORT TITLE: Hydrocarbons/Atmospheric Measurements

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PRINCIPAL INVESTIGATOR AND AFFILIATION:      H. Niki  
York University

LIAISON OFFICER (name, location, telephone no.): E. Singer  
Air Resources Branch  
965-4081

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OBJECTIVE(S): To measure, using gas chromatography/mass spectrometry, a number of key volatile organic species, particularly biogenic hydrocarbons in the oxidant/acid rain problem to be compared against model predictions and also to gain a better understanding of atmospheric chemistry in a Canadian setting, as part of the Eulerian Model Evaluation Study.

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PROJECT DESCRIPTION: The proposal measurement program will be related to the CIRAC-endorsed Canadian Atmospheric Chemistry Study as part of the Eulerian Model evaluation Field Study. Air samples collected at the Ministry's site at Dorset and other appropriate forested areas will be analyzed by GC/MS in the laboratory mainly for natural hydrocarbons such as isoprene and terpenes. An important component of this program is a critical evaluation and improvement of existing sample collection and handling techniques employed for GC/MS based identification and quantification of these labile compounds.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	120.0	68.2	68.2	256.4

Work Years:

Budget Source: RAC

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KEYWORDS: hydrocarbons, volatile organics, atmospheric measurement, natural organics

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Development of Standards for Safe Gas Composition Limits and of a System to Shorten the De-energization (Outage) of Electrostatic Precipitators in Cement Plants During Explosive Conditions      PROJECT NO: 402G  
START DATE: 04/88

SHORT TITLE: Gas Composition Limits

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      I. Inculet  
University of Western  
Ontario

LIAISON OFFICER (name, location, telephone no.):      J. Manuel  
London Regional Office  
(519) 661-2200

OBJECTIVE(S): Development of Standards for Safe Gas Composition Limits and of a System to Eliminate or Shorten the De-energization (Outage) of Electrostatic Precipitators in Cement Plants During Explosive Conditions.

PROJECT DESCRIPTION: Analysis of composition of the gases which enter the electrostatic precipitators installed in two representative cement plants in Ontario as chosen by the Ontario Ministry of the Environment. Tests to determine the minimum ignition energy levels for the above gas mixtures. Tests to investigate the effects of the dust loadings on the minimum ignition energy levels. Tests to determine the time characteristics of pre-spark discharge currents in selected CO/H<sub>2</sub> mixtures. Development of an electronic system for channeling the sparking outside the electrostatic precipitators installed in cement plants.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):		35.5	26.0		61.5
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Work Years:

Budget Source: RAC

KEYWORDS: stack gas, explosive conditions, precipitation outage, ignition energy levels.

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Modelling of the Fluctuation of Air  
Pollutant Concentrations

PROJECT NO: 403C  
START DATE: 04/88

SHORT TITLE: Air Pollutant/Modelling

PRINCIPAL INVESTIGATOR AND AFFILIATION:

E. Robertson  
Atomic Energy Research  
Laboratory

LIAISON OFFICER (name, location, telephone no.):

P. Misra  
Air Resources Branch  
235-5771

OBJECTIVE(S): To test code and procedures on sites selected by the Ministry where data are available.

PROJECT DESCRIPTION: At present, the only reliable method of predicting the frequency distribution of fluctuating air pollutant concentrations from a single source is to combine a Gaussian plume model with archived real-time meteorological data or reconstructed data from climatological summaries. A code for doing this is available and has been tested at one location. Further testing is desirable. This is a proposal to test the code at sites selected by Ministry of Environment staff and, if upon further testing it is suitable, to apply it on a contractual basis to sites selected by the Ministry.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	6.0				6.0
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Work Years:

Budget Source: RAC

KEYWORDS: frequency, fluctuating air pollutant, Gaussian plume model

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: A Study of the Status of Root Systems and Mycorrhizal Association in Healthy and Declining Sugar Maple

PROJECT NO: 404G  
START DATE: 04/88

SHORT TITLE: Sugar Maple Root Systems

PRINCIPAL INVESTIGATOR AND AFFILIATION: T. Hutchinson  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): W. McIlveen  
Air Resources Branch  
965-4516

OBJECTIVE(S): To provide a comprehensive answer to the question of whether the mycorrhizal associations of sugar maple are being adversely affected by soil status, or whether this is a precursor or a co-occurrence with onset of decline.

The University will also determine whether the potential disruption of mycorrhizal associations can be caused by increases in soluble aluminum in soils. They have large numbers of carefully collected samples and seek funds to properly analyse these, as well as carrying out some bioassay and Al treatment experiments.

PROJECT DESCRIPTION: The occurrence of declining sugar bush is widely reported in Quebec and also in Ontario, especially on the Pre-Cambrian Shield, and from New Brunswick, New York, Vermont, Massachusetts, and Pennsylvania. The specific causes are not yet established, though the common symptomology for the whole area suggests common factors. Nutritional status of trees seems adversely affected. The problems are greatest on the poorest soils. The University's experiments suggest the problem at least partially resides in the root - soil systems, probably involving soil acidification. In this proposal they intend to determine whether the root systems of declining sugar maple in forest stands have problems with their mycorrhizal associations. They have already collected large numbers of root system samples from trees covering a wide range of decline status - from healthy to severe. These will be examined for their mycorrhizal associates. The University also has experimental placed bags of declining and health "soil" around declining and healthy trees, to allow natural root colonization of the bag. These bags are now ready for sampling for root density, vigor, elemental composition and mycorrhizal status. Experiments will also examine the response of mycorrhizal infection to aluminum status of soils at low pH.

BUDGET AND RESOURCES:	Year: (*current)	1*	2	3	TOTAL
	Cost: (\$000's):	35.3			35.3

Work Years:

Budget Source: RAC

KEYWORDS: root systems, mycorrhizal associations, sugar maple, decline, soluble aluminum, soil

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Determination of the Dose-Responses for Tissue Contamination and Growth of Vegetable Crops Exposed to Chronic Levels of Organic Environmental Contaminants Originating from Industrial Processes

PROJECT NO: 405G  
START DATE: 04/88

SHORT TITLE: Organic Contaminants/Dose-Response Study

PRINCIPAL INVESTIGATOR AND AFFILIATION: D. Ormrod  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): D. Harper  
Air Resources Branch  
456-2504

OBJECTIVE(S): To establish bioaccumulation of trichloromethane and phenol through foliar exposure at concentration ranges including ambient standards using radish, lettuce and tomato. To establish bioaccumulation of trichloromethane and phenol through contamination of the root zone at a range of concentrations including ambient standards using radish, lettuce and tomato. To assess the relative importance of foliar and root exposures to bioaccumulation of these compounds in plant tissue, and establish partitioning indices as well as dose-response relationships between the two pathways of exposure and tissue accumulation. To assess the phytotoxicity of these compounds by root, foliar, and root and foliar exposure. Phytotoxicity will be evaluated by determining dose-response relationships between growth parameters and contaminant concentrations applied to the growing medium.

PROJECT DESCRIPTION: The current emphasis on evaluating the environmental hazard of various phytoaccumulation and phytotoxicity exists for a few compounds and a small variety of plants, it is insufficient data to thoroughly predict the impact of industrial contamination on human dietary ingestion, and on growth processes of the plants themselves. Uptake by plants may occur via two pathways, foliar and root; the pathway may influence the eventual concentration of contaminants in edible portions, or the growth effects on different plant parts. The predominant pathway will depend on the medium which is contaminated, although in many situations both soil and air will be part of plant exposure. There is a need for an integrated study which evaluates the effects of chronic concentrations of several contaminants on three vegetable groups (root vegetables, leafy vegetables and fruit vegetables), by comparing the roles of the pathway of exposure on phytoaccumulation in various plant parts, injury and growth suppression. This research will lead to a better understanding of how industrial contaminants are partitioned in the terrestrial environment, leading to better human and eco-risk assessment.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	46.4			46.4
Work Years:				

Budget Source: RAC

KEYWORDS: bioaccumulation, radish, lettuce, tomato, foliar, root zone, partitioning indices, dose-response, phytotoxicity

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Development of Standard Methodology for the Evaluation of Organic Contaminants Leaching from Municipal and Industrial Wastes	PROJECT NO: 406G
	START DATE: 04/88

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SHORT TITLE: Municipal Waste/Leaching

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	F. Karasek University of Waterloo
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LIAISON OFFICER (name, location, telephone no.):	D. Toner Laboratory Services Branch 235-6015
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OBJECTIVE(S): To develop methodology for the rapid evaluation of the leaching of organic contaminants from a variety of different sources of waste material. A standard testing procedure applicable to a wide range of organic compounds and waste types will be developed and tested.

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PROJECT DESCRIPTION: Many different types of municipal and industrial wastes are introduced into the environment during their disposal. The types and levels of organic contaminants leached from the waste must be realized. A method for evaluating the leachability of organic pollutants from waste is necessary. This study will involve the development of a standard evaluation procedure which will be implemented by the Ministry for later studies. A large number of various waste types will be studied in order to provide the Ministry with a data base of information regarding the leaching of organic pollutants from municipal and industrial wastes.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	46.0			46.0

Work Years:

Budget Source: RAC

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KEYWORDS: municipal/industrial waste, leachability, organic pollutants, chromatography

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OUTPUT (papers, presentations, reports): Report

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: An Investigation of Vibration Isolation in a House for Reduction of Train Vibration  
PROJECT NO: 407C  
START DATE: 04/88

SHORT TITLE: House Isolation/Train Vibration

PRINCIPAL INVESTIGATOR AND AFFILIATION: J. Rainer  
National Research Council  
Canada

LIAISON OFFICER (name, location, telephone no.): V. Schroter  
Land Use Planning Section  
323-4463

OBJECTIVE(S): To determine the characteristics of ground vibrations from trains at two locations.

To determine the effectiveness of a given vibration method in reducing train-induced vibrations in a test house.

PROJECT DESCRIPTION: This proposal is in 3 parts. Each part is self-contained; however, the parts complement each other, so that a comprehensive investigation into train vibration effects on houses will emerge. Part I consists of evaluating transducer mounting techniques in the ground so that reliable measurements can be assured. Part II characterizes the ground vibrations from trains at 2 locations, and Part III evaluates the effectiveness of a vibration isolation method in a test house.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		20.7	52.7		73.4

Work Years:

Budget Source: RAC

KEYWORDS:

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Assessment of Biologically Based Low  
Flow Analysis Technique

PROJECT NO: 408C  
START DATE: 04/88

SHORT TITLE: Low Flow Analysis Technique

PRINCIPAL INVESTIGATOR AND AFFILIATION:

H.S. Belore  
Cumming Cockburn Limited

LIAISON OFFICER (name, location, telephone no.): Z. Novak

Water Resources Branch  
323-4804

OBJECTIVE(S): To assess the practical usefulness of the biologically-based method. To confirm the merit in continued use of 7Q<sub>20</sub> and/or suggest an alternative xQy criteria which could be more consistent with environmental constraints and concerns (i.e. would 7Q<sub>20</sub> or another hydrologically based criteria be more appropriate?).

This would also provide additional data which could be included in the ongoing inventory of streams and dischargers presently being undertaken by the Ministry.

PROJECT DESCRIPTION: Provincial water quality objectives for streams and rivers rely on characterizing low flows. In particular, reference is commonly made to 7Q<sub>20</sub> for assessing the effect of pollutant discharges to receiving streams (steady state analysis). There is apparently little rational justification for using this particular low flow index.

A procedure for characterizing low flow conditions using a 2-parameter water quality/biological index method combined with an empirical analysis of existing discharge data was recently developed by the U.S. EPA and is available as a computer program. The proposed research program would modify this program to execute using available Canadian data, test and evaluate the program (and associated indices) on 20 suitable streams, compare the results to the hydrological low flow method and make recommendations concerning the usefulness of the method and whether the results can be used to justify 7Q<sub>20</sub> or some other xQy hydrological low flow.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	23.0			23.0
	Work Years:				

Budget Source: RAC

KEYWORDS: low flow, biological assessment

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Test of a Chemical Mechanical Hammermill Process for the Decontamination of Non Anatomical Biomedical Waste	PROJECT NO: 409G START DATE: 04/88
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SHORT TITLE: Waste Disposal/Biomedical Wastes

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Paul A.W. Gamble Hospital Council of Metro Toronto
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LIAISON OFFICER (name, location, telephone no.):	J. Manuel Waste Management Branch 323-5125
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OBJECTIVE(S): To assess air, liquid and solid discharges from equipment known as Medical SAFETEC waste management system used for the decontamination of non-anatomical biomedical waste for the presence of hazardous chemicals & microorganisms when the equipment is operating in a collective hospital environment.

PROJECT DESCRIPTION: The equipment will be located at the waste handling area of the Booth Avenue Hospital Laundry, Toronto, and will be operated and maintained by Booth Avenue staff. The Test period will extend for a period of not less than six months and all discharges will be regularly sampled and analyzed and reported. Analytical procedures will conform to a testing protocol agreed to by the Hospital, the Ministry of Health, Labour and Environment and the local public health authority. Routine analysis of samples is to be carried out by a private laboratory. A copy of all test results is to be provided to all participating agencies during the test period and thereafter on an agreed schedule.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	95.0			95.0
	Work Years:	1			

Budget Source: RAC

KEYWORDS: biomedical, waste, hammermill, disposal, hazardous chemicals and micro-organisms

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract X	Solicited
INTERNAL X	Grant	Unsolicited X

PROJECT TITLE: Landfill Monitoring Protocol  
Development for Ontario

PROJECT NO: 410C  
START DATE: 04/88

SHORT TITLE: Protocol Development

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Hans Mooij  
Waste Management Branch  
(previously with - H. Mooij  
& Associated Ltd.)

LIAISON OFFICER (name, location, telephone no.):

G. Hughes  
Waste Management Branch  
323-5216

OBJECTIVE(S): To develop practicable recommendations to the Ministry of the Environment, based on expert consensus positions and documented present practices and procedures, for the development of landfill leachate and groundwater quality monitoring protocols and procedures.

PROJECT DESCRIPTION: The Ministry of the Environment has developed draft guidelines on monitoring landfills. These guidelines specify monitoring objectives and performance rather than methodology. The research project will document current monitoring practices in Ontario and other jurisdictions. This will be the basis of a background document which will serve as the subject for a round-table discussion between selected experts in the field of landfill monitoring in order to develop consensus positions on all aspects of monitoring program protocols, procedures and practices. Particular attention will be paid to the merits of establishing guidelines that specify acceptable and required monitoring methodology.

This research approach will be assessed with respect to its applicability in the development of other Ministry guidelines.

BUDGET AND	Year: (* current)	1	2	3	TOTAL
RESOURCES:					

Cost: (\$000's):	21.6				21.6
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Work Years:

Budget Source: RAC

KEYWORDS: landfill leachate, groundwater, monitoring procedures  
recommendations, expert consensus

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: As H. Mooij is now on staff, it is planned to complete the work in house.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Glassification and Leachability of  
Hazardous Waste Residues

PROJECT NO: 411C  
START DATE: 04/88

SHORT TITLE: Glassification

PRINCIPAL INVESTIGATOR AND AFFILIATION:

K.B. Harvey  
Atomic Energy Research  
Laboratories

LIAISON OFFICER (name, location, telephone no.):

G. Custonguay  
Waste Management Branch  
323-5214

OBJECTIVE(S): To make a first estimate of the value of immobilizing hazardous waste materials and residues in a silicate glass matrix. If the resulting concentrations or rates of release into simulated groundwaters are significantly reduced when compared with conventional methods for immobilization, this could form the basis for the development of low- or controlled-release waste forms, and of novel means for the treatment and disposal of hazardous wastes.

PROJECT DESCRIPTION: A simulated hazardous waste residue will be immobilized in a soda-lime silicate glass under conditions that will simulate several waste types, and immobilization routes. Complete chemical analyses of the starting materials and of the completed waste forms will be made in order to determine the effect of different treatment routes on any loss of volatile metals.

Release from the waste forms into water or simulated leachate will be measured both by the standard leachate extraction procedure, and by an extended dynamic test, at 20 to 25°C, and at 10°C to simulate an average year-round ground temperature. Release from the waste forms will be followed both by chemical analysis of the leachants, and by the addition of radioactive tracers.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
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Cost: (\$000's):	58.5	3.3			61.8
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Work Years:

Budget Source: RAC

KEYWORDS: hazardous wastes, groundwater, immobilization glassification, leachability

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Chlorinated and Nonchlorinated Organics Storage Studies PROJECT NO: 412C  
START DATE: 04/88

SHORT TITLE: Organic Storage Studies

PRINCIPAL INVESTIGATOR AND AFFILIATION: Neaves  
Enviroclean

LIAISON OFFICER (name, location, telephone no.): Patrick W. Crozier  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): The main objective of the proposed study is to provide the ministry with a manual documenting the maximum storage times and conditions for which organic samples may be kept before analytical results become invalid. The project should include: Conducting a comprehensive literature review of the stability of organic compounds during storage of environmental samples, contacting other agencies such as the United States Environmental Protection Agency, Environment Canada, Canada Centre For Inland Waters, and Academic Researchers, to obtain unpublished and internal reports on the stability of organics in stored samples. Recommending storage times/conditions for organics monitored by MOE in various matrices including water, effluents, soils/sediments, air, vegetation and biota. Identifying areas in which additional research on the storage times and conditions for organic substances is needed.

PROJECT DESCRIPTION: Phase I - Literature Review  
In this phase of the project a comprehensive and critical literature review of published stability/storage studies for organic compounds currently monitored by Ministry of the Environment organic analyses sections would be undertaken. Agencies such as the United States Environmental Protection Agency (USEPA), Environment Canada, Canadian Centre for Inland Waters (CCIW), and others identified by MOE staff should be contacted for unpublished/internal reports as well as the normal search procedures. Due to the enormous scope of the literature review, further discussion of priorities with ministry staff will be necessary.  
The effect of storage conditions, storage time, and matrix on compound degradation (or in some cases compound production) should be highlighted.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	47.0			47.0
	Work Years:				

Budget Source: RAC

KEYWORDS: organics, storage, water, effluents, air, soils, vegetation, biota

OUTPUT (papers, presentations, reports): 3 phase manual expected

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Contract awarded late so no presentation possible for the 1988 Technology Transfer Conference.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Solid Phase Extraction of Triazines  
and Organophosphorus Compounds from Water

PROJECT NO: 413C  
START DATE: 04/88

SHORT TITLE: Phase Extraction/Phosphorus Compound

PRINCIPAL INVESTIGATOR AND AFFILIATION:

W.G. Craig  
Paracel Laboratories Ltd.

LIAISON OFFICER (name, location, telephone no.):

D. Hall  
Laboratory Services Branch  
235-5910

OBJECTIVE(S): To determine if the use of solid phase extraction for the extraction of triazines and organophosphorus compounds is an appropriate analytical procedure, and

Identify which parameters, if any, of the methodology need to be studied further, or optimized, before its adoption as a routine analytical technique.

PROJECT DESCRIPTION: The possibility of using the technique of solid phase extraction will be examined for the analysis of triazine and organophosphorus compounds in water. This feasibility study will include an in-depth examination of methods to enhance recoveries and reduce interferences, as well as examining the reproducibility of the technique. Parameters to be studied include: selection of the best solid phase and eluting solvent, selection of the best supplier, determination of the stability of lots, various methods to reduce interferences, the consistency of recoveries, application to real samples, and the time stability of adsorbates.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	50.0	2.5			52.5
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Work Years:

Budget Source: RAC

KEYWORDS: solid phase extraction, water, triazine, organophosphates method optimization

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Flow Injection Sample Introduction for Inductively Coupled Plasma Atomic Emission and Mass Spectrometry      PROJECT NO: 414G  
START DATE: 04/88

SHORT TITLE: Flow Injection Sample

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Eric D. Salin  
McGill University

LIAISON OFFICER (name, location, telephone no.): D. Boomer  
Laboratory Services Branch  
235-5858

OBJECTIVE(S): To generate a sample introduction for trace level determinations with the following characteristics: 1) Detection limit improvements of at least a factor of 100. 2) Reduction or elimination of matrix effects. 3) Sample throughputs of 30 to 60 per hour. 4) A chemical methodology suitable to a variety of sample types.

Secondary objectives: 1) Automation of sample input using the direct sample insertion device for icp-aes and icp-ms. 2) Feedback from the instrument (or controller) to the sample introduction system so as to provide for intelligent modification of the experiment by either changing the chemistry (select different flow injection system parameters) or handling technique (e.g. standard additions or matrix matching) when justified by "expert" computer analysis of the data. 3) Component speciation.

PROJECT DESCRIPTION: A high performance sample introduction system based on flow injection techniques will be developed for inductively coupled plasma atomic emission and mass spectrometry. The system should provide detection limit improvement factors of 100 to 10,000 for atomic emission using direct insertion and from 100 to 1,000 for mass spectrometry using direct insertion. The detection limit improvements should be even more dramatic in cases where the matrix causes drastic degradation in detection limits. The flow injection procedure should minimize matrix effects thereby enhancing accuracy. Precisions of approximately 1% are expected.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		46.5	46.5	39.5	132.5
Work Years:					

Budget Source: RAC

KEYWORDS: ICP, flow injection, ultr-trace, elemental analysis

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Effectiveness of the Greenhill Combined Sewerage Overflow Storage Facility	PROJECT NO: 415G START DATE: 04/88
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SHORT TITLE: Waste Treatment/Greenhill Sewage Treatment

PRINCIPAL INVESTIGATOR AND AFFILIATION:	G.S. Spencer The Regional Municipality of Hamilton-Wentworth
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LIAISON OFFICER (name, location, telephone no.):	J. Vogt West-Central Region (416) 521-7732
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OBJECTIVE(S):

Design - To determine if existing design criteria is appropriate. To compare previous predictive models with more current models under field conditions.

Operation - To examine the effectiveness of the control strategy. To examine the effect on Greenhill Avenue Trunk Sewer. To examine the effect on Woodward Avenue Sewage Treatment Plant. To examine maintenance and operation.

Conclusion - Cost-Benefit. Overall effectiveness.

PROJECT DESCRIPTION: This study is intended to review the effectiveness of the recently-constructed Greenhill combined sewer overflow (off-line) Sewerage Facility: 1) To identify the design criteria used; 2) To record accumulated operating data on the Facility over the study period; 3) To analyze the data accumulated; 4) To assess the operation of the facility; and, 5) To make appropriate recommendations and conclusions.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	31.7				31.7
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Work Years:

Budget Source: RAC

KEYWORDS: combined sewer overflow retention/treatment tank, design evaluation

OUTPUT (papers, presentations, reports): Report

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Assessment of Fecal Pollution Transport PROJECT NO: 416G  
in Agriculturally Impacted Watersheds Using a Biotracer START DATE: 04/88

SHORT TITLE: Watersheds/Fecal Pollution

PRINCIPAL INVESTIGATOR AND AFFILIATION: Michael Walters  
Lake Simcoe Region  
Conservation Authority

LIAISON OFFICER (name, location, telephone no.): M. Young  
Laboratory Services Branch  
235-5890

OBJECTIVE(S): (1) To develop an instream pollution tracing methodology using a Nalidixic Acid resistant *E. coli* bio-tracer. (2) To use the methodology to determine the potential for instream fecal pollution transport to beach areas from source points in rural watersheds. (3) To monitor the extent of downstream deposition of the bacteria used in #2. (4) To assess the potential for resuspension and transport of contaminated sediment to downstream areas over a period of time.

PROJECT DESCRIPTION: The Lake Simcoe Conservation Authority and the Metropolitan and Region Conservation Authority in cooperation with the Ministry of the Environment have undertaken beach clean-up initiatives aimed at agricultural pollution. The development of simple models for evaluating source inputs and transport of pollutants are essential for watershed remedial action strategies. A critical input to the modelling process is the bacterial transport time between source points and beach areas. It is therefore necessary to obtain modelling information through field experiments utilizing tracers which accurately simulate the waste stream movement in receiving waters, and to conduct such in vivo experiments at different locations and under various conditions. The project proposed here will provide previously unavailable information on the in stream transportation of an important fecal indicator bacteria, *E. coli*.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	60.4				60.4
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Work Years:

Budget Source: RAC

KEYWORDS: bacterial transport, biotracer, *E.coli*, Nalidixic Acid, instream

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC. Branch. etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Wildlife Toxicology Fund Projects                      PROJECT NO: 417G  
START DATE: 04/88

SHORT TITLE: Wildlife Toxicology

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Monte Hummel  
World Wildlife Fund Canada

LIAISON OFFICER (name, location, telephone no.): J. Pagel  
Research & Technology Branch  
323-4576

OBJECTIVE(S): Wildlife Toxicology Fund (WTF) was established on June 4, 1985 through a Memorandum of Understanding between Environment Canada and World Wildlife Fund Canada. Its purpose is to provide high quality scientific information that can be directly applied to the protection of Wildlife in Canada from irreversible harm caused by toxic chemicals in the environment, and to enhance and develop private sector expertise, and to act as stimulus for the joint funding of research projects.

The objective of this proposal is to contribute \$50,000 per year for up to three years to the World Wildlife Fund to fund on a cost shared basis, projects which have been recommended for approval and cost sharing by WWF.

PROJECT DESCRIPTION: The research priorities of TWF include: Effects of agricultural and/or forestry chemicals on wildlife, effects of toxic industrial pollutants on wildlife, monitoring the success of measures taken to mitigate the effects mentioned in the above two priorities, developing and implementing techniques that use wildlife as indicators of toxic chemicals in the environment, examining environmental pathways by which toxic substances may affect wildlife.

Proposals which meet the research priorities of the WTF and are recommended by the RAC will be circulated to the Research Advisory Board of WTF. If approval is obtained from both committees, and if matching funds are in place, a specified amount of MOE's contribution will be released for the project.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	50.0			50.0
	Work Years:				

Budget Source:

KEYWORDS:

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Environmental Evaluation Research

PROJECT NO: 418G  
START DATE: 04/88

SHORT TITLE: Environmental Research

PRINCIPAL INVESTIGATOR AND AFFILIATION:

J. Knetsch  
Simon Fraser University

LIAISON OFFICER (name, location, telephone no.):

O. Salamon  
Policy & Planning Branch  
323-4561

OBJECTIVE(S): To improve the basis for economic valuation of environmental changes; to investigate assessment and policy implications of the recent findings of large disparities between willingness-to-pay and compensation-demanded measures of economic values; to study preference and choice behaviour of people with respect to alternative environmental policies; to examine various legal sanctions; and to further examine the development and use of economic experiments for research in these areas.

PROJECT DESCRIPTION: The research will be carried out in a continuing series of individual experimental and survey studies, conducted in part in Ontario. The results of earlier studies will be used to design later empirical efforts, which will take full advantage of the large degree of complementarity among the individual studies. While the Principal Investigator will be responsible for the research, including studies in Ontario, it is anticipated that the Research Assistant and other colleagues will actively participate in expanding the research program.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	24.9	24.5	26.0	75.4
	Work Years:				

Budget Source:

KEYWORDS: benefit valuation, measuring, non-pecuniary values, willingness-to-pay, compensation-demanded

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Salt Spray Injury Study	PROJECT NO: 419G
	START DATE: 04/88

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SHORT TITLE:

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. C. Chong Horticulture Research Inst. Ministry of Agriculture and Food
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LIAISON OFFICER (name, location, telephone no.):	G. Vasiloff Air Resources Branch 456-2504
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OBJECTIVE(S): To conduct additional field and laboratory experiments to determine the suitability of several chemicals for protecting roadside vegetation from salt spray injury.

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PROJECT DESCRIPTION: Investigations during the next two winters will repeat the field work of Piedrahita (cf. Final Report ME-87-19) with regard to sites, species and chemicals. Branches or twigs of eight species along major highways will be treated with Joncryl 1938, RD 1726, RD 1725, Folicote and Rhodorsil. Sodium and chloride contents and degree of injury will be determined. Additional investigations will also involve the testing of four new chemicals, which are related to RD 1725, one of the most promising of the five test chemicals.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	15.0			15.0

Work Years:

Budget Source: RAC

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KEYWORDS: salt spray injury, chemical protection, RD 1725

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies): MOE

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X Contract Solicited  
INTERNAL Grant X Unsolicited X

PROJECT TITLE: Adaptation of Water Preconcentration Techniques Developed for PCDD Analysis to Other Target Organic Pollutants PROJECT NO: 420G  
START DATE: 04/88

SHORT TITLE: PCDD Analysis/Preconcentrations Techniques

PRINCIPAL INVESTIGATOR AND AFFILIATION: B. Hollebone  
Carleton University

LIAISON OFFICER (name, location, telephone no.): S. Suter  
Laboratory Services Branch  
235-5895

OBJECTIVE(S): The ability to preconcentrate large volumes of treated or natural waters in the field for accurate dioxin analysis will be extended to the quantification of other classes of toxic organics in these waters. Three refinements of current technology are required: 1) Characterization of the filter capacity, retention of organics, interferences and elution behaviour of filter cartridges. 2) Capacities, interferences and elution recoveries from XAD resins selected for retention of target organics. 3) Optimization of filter-resin combinations in sampler operation or retention and separation of organics in either the solid or aqueous phases of natural water.

PROJECT DESCRIPTION: The ppq dioxin sampler will be adapted to preconcentrate representative PAH and chlorinated pollutants in natural waters. This requires characterization of radial filters, adsorbate resins and total sample performance to determine recoveries and interferences for each compound type. Radial filters will be assessed for total filter capacity, the retention of varying particle size, the retention of spiked organics, the efficiency of elution and the presence of interferences. Similarly, the retention, recovery and the role of interferences for hydrophobic organics on XAD resins will be assessed. Sampler protocol will then be tested in a small scale mockup of the sampler and verified in a new sampler built to duplicate the one delivered earlier to MOE. The recoveries will be determined by the optimized workup and elution procedures and by GC/MSD identification and quantification. All work will be done in distilled water, distilled water doped with illite clay and treated water.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	116.0	70.0		186.0
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Work Years:

Budget Source: RAC

KEYWORDS: sampler, organics, CDD/CDF, resin, filters, adsorbents

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Recycling of Textile Dyebath Effluents PROJECT NO: 421G  
START DATE: 06/88

SHORT TITLE: Textile Dyebath Effluents

PRINCIPAL INVESTIGATOR AND AFFILIATION: Anne Wilcock  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): J. Smart  
Waste Management Branch  
323-5113

OBJECTIVE(S): To test the efficiency of a new, commercially available electrochemical cell in the purification of environmentally hazardous textile dyebath effluents. These effluents contain expensive dyes and other chemicals that, if they can be precipitated from the effluent and reused, represent a substantial economic saving. The colourless supernatant will be tested for biological toxicity and for potential industrial recycling so that manufacturers will have the option of safely discharging the treated effluent to sewers or recycling it in industrial applications.

PROJECT DESCRIPTION: To simulate the recycling of industrial dyebath effluent, an aqueous solution containing one of three common disperse dyes and a biphenyl carrier will be electrochemically separated into dye, carrier and water. The purity and potency of the recovered dyes and carriers will be tested by application to a polyester fabric. The water will be tested for toxicity by fish bioassay, and for reuse potential. The electrochemical separation system will then be tested in actual industrial conditions using disperse and other classes of dyes.

BUDGET AND RESOURCES:	Year: (*current)	1*	2	3	TOTAL
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Cost: (\$000's):	18.9	17.6	13.4	49.9
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Work Years:

Budget Source: RAC

KEYWORDS: recycling, re-use, textile dye, toxicity

OUTPUT (papers, presentations, reports): Report

EXTERNAL PARTICIPATION (ministries, governments, agencies): None

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited X  
Unsolicited

PROJECT TITLE: Development of a Method for the  
Analysis of Brominated Dibenzo-p-dioxins (BDD) and  
Brominated Dibenzofurans (BDF) in Environmental  
Samples by GC/MS

PROJECT NO: 422C  
START DATE: 06/88

SHORT TITLE: BDD and BDF Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION:

R.E. Clement  
Laboratory Services Branch

LIAISON OFFICER (name, location, telephone no.):

D. Schellenberg  
Laboratory Services Branch  
235-5890

OBJECTIVE(S): The contractor will: Gather and review all available international information regarding the toxicities of BDD/BDF and mixed C/BDD and C/BDF. Gather and review all available international information regarding the sources and environmental occurrence of these compounds. Gather and review all available international information regarding analytical methodologies in use for the detection and quantification of these compounds. Provide a list of current commercial supplies of analytical standards for these compounds.

PROJECT DESCRIPTION: The Contractor will perform a comprehensive search and review of the technical literature and other sources of published and unpublished information pertaining to the toxicities, environmental occurrence and analysis of BCC/BDF and mixed C/BDD and C/BDF. The Contractor's proposal must include details of the search strategy to be employed, which should include computerized searching of chemical abstracts, keywords to be used, names of databases to be searched, use of NTIS reports and Citation Index, manual journal searches and personal contact with leading international researchers.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	23.0				23.0
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Work Years:

Budget Source: RAC

KEYWORDS: brominated dibenzo-p-dioxins (BDD) and Dibenzofurans (BDF), literature review, toxicities, sources, environment, analytical methods of detection/quantitation, suppliers

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Chemical Exposure Pathways in Ontario	PROJECT NO: 423G
	START DATE: 07/88

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SHORT TITLE: Chemical Exposure Pathways

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D. MacKay  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): J. Smith  
Hazardous Contaminant Branch  
323-5113

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OBJECTIVE(S):

- 1) Establish correspondence between output of environmental model and prevailing concentrations in Ontario.
  - 2) Establish a range of air inhalation and water and food consumption rates for a typical family in Southern Ontario.
  - 3) Develop correlations between concentrations in the environment and those in vegetation, fruit, meat, and dairy products.
  - 4) Quantify human exposure through ambient air, food, and water.
  - 5) Extend assessment to estimation of human physiological fate to chemicals through further development of existing pharmacokinetic model.
  - 6) Validation of the set of models.
- 

PROJECT DESCRIPTION: A multi-media fugacity based environmental model estimates prevailing concentrations in various media such as air, water, soil, sediment, and fish has been developed and validated for a number of chemicals in Southern Ontario. Concepts of this model will be extended to assess exposure to these and additional chemicals by a typical Southern Ontario family through air inhalation and food and water consumption, as well as human physiological distribution and body burden. To quantify these exposures, it will be necessary to (i) establish a range of typical food consumption rates, (ii) develop expressions to correlate concentrations in soil, air, and water with those in vegetation, fruit, meat, and dairy products, and (iii) refine and apply our recently developed pharmacokinetic model. Predicted exposures and body burdens will be compared with those known to cause toxic effects in order to assess their severity.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	49.5	43.5	43.5	136.5
	Work Years:				

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Budget Source: HCCB

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KEYWORDS: air, inhalation, fugacity, water, soil, sediment, fish

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Monitoring Exposure and Effects of Organic Substances in the Huron-Erie Corridor	PROJECT NO: 424G START DATE: 08/88
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SHORT TITLE: Organic Substances/Huron-Erie Corridor

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. P. Hebert Great Lakes Institute University of Windsor
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LIAISON OFFICER (name, location, telephone no.):	A. Hayton Water Resources Branch 235-5800
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OBJECTIVE(S): There are five interactive subprojects:

1. To establish protocols for a statistically sound network of biomonitoring stations in the Huron-Erie corridor.
2. To determine foodweb exposure routes (water or in-place pollutants).
3. To calibrate organisms of both the benthic and pelagic food chains in order to determine water and sediment concentrations.
4. To determine if bioaccumulation or bioconcentration regulates residue levels in sport fish.
5. To establish vertebrate monitors to assess the impact of contaminants in the Huron-Erie corridor.

PROJECT DESCRIPTION: 5 sites will be set up along the Huron-Erie corridor to investigate temporal and spatial heterogeneity of contaminants in various media. Three times during the year food web transfers and community structure will be determined at three of the sites. Two benthic organisms will be calibrated to determine influence of sediment uptake. The MOE sport fish data base will be computerized. Impact studies initiated with collection and testing of natural populations.

Spatial redundancy corrected by rejecting sites with no significant spatial variability. First foodwebs constructed. Breeding of both brown bullhead and bluntnose minnow populations will be initiated for mutagenicity studies.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	200.0	200.0	200.0	600.0
	Work Years:	7.0	7.0	7.0	21.0

Budget Source: Environmental Services Division

KEYWORDS: contaminant-monitoring, Huron-Erie Corridor, toxicokinetics, biomonitoring, food-chain

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Monitoring and Evaluation of Landfill  
Cover Lysimeters

PROJECT NO: 425C  
START DATE: 10/88

SHORT TITLE: Landfill Lysimeter Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION:

K.J. McKague  
Ecologistics Limited

LIAISON OFFICER (name, location, telephone no.): C.A. Bostock

Waste Management Branch  
323-5218

OBJECTIVE(S): To continue uninterrupted monitoring of the existing six (6) lysimeters located at the Britannia Road Landfill site with an outlook to confirming the viewpoint that they are operational and will continue to function through the fall, winter and spring.

PROJECT DESCRIPTION: Modifications to an initial lysimeter design have been made to the point where it is believed that the lysimeters are now functioning as intended. It is proposed that data collection and analysis continue in order to test the performance of the modified lysimeters through the four climatic seasons.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	15.0			15.0
	Work Years:	0.21			0.21

Budget Source: Waste Management Branch

KEYWORDS: modified lysimeters, Britannia Road Landfill, monitoring, performance evaluation

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

AIR RESOURCES BRANCH PROJECTS

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RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Fluoride Criteria Studies

PROJECT NO: ARB  
START DATE: 11/85

SHORT TITLE: Fluoride Criteria

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Mr. R.D. Jones  
Phytotoxicology Section  
Controlled Environment  
Library, Brampton  
456-2504

LIAISON OFFICER (name, location, telephone no.): D.S. Harper

Air Resources Branch  
456-2505

OBJECTIVE(S): To conduct a series of controlled environment exposures to evaluate the current (proposed) 24 gaseous fluoride criteria in air, with respect to injury to vegetation.

PROJECT DESCRIPTION: Various species of plants with known sensitivity to gaseous fluoride are being exposed to fluoride concentrations at and above 1ppb (v/v) (0.86ug/l) for 24 hours. Injuries resulting from these exposures are rated and the plant tissue evaluated including: Manitoba maple, plum, gladiolus, apricot, tulip, wild grape and white pine. On completion, the validity of the 24 hour criterion (1ppb) will be assessed.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	22.0	22.0	36.0	98.0
	Work Years:	0.5	0.5	0.75	1.75

Budget Source: ARB

KEYWORDS: fluoride, controlled exposure, vegetation

OUTPUT (papers, presentations, reports): The results will be published in a Ministry report and possibly in a referred Journal.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

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PROJECT TITLE: Eulerian Model Evaluation Field Study      PROJECT NO: ARB  
START DATE: 06/88

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SHORT TITLE: Eulerian Model

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PRINCIPAL INVESTIGATOR AND AFFILIATION:      Mr. N. Reid  
Air Resources Branch  
880 Bay Street  
Toronto, 965-1634

LIAISON OFFICER (name, location, telephone no.): W. Chan  
Air Resources Branch

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OBJECTIVE(S): To collect special atmospheric chemistry measurements on acid-rain-related compounds, for evaluation of Eulerian long-range transport studies.

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PROJECT DESCRIPTION: Measurements of sulphur and nitrogen oxides in air and precipitation, and related compounds, are made in Dorset and a number of other sites.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	220.0			220.0
	Work Years:	3.0			3.0

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Budget Source: ARB

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KEYWORDS: Acid rain, atmospheric chemistry

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies): USEPA, EPRI, Environment Canada

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Method Development for PAH's in  
Ambient Air

PROJECT NO: 298PL  
START DATE: 03/86

SHORT TITLE: PAH's in Ambient Air

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. G. Diamond  
Air Resources Branch  
880 Bay Street  
Toronto, 965-4081

LIAISON OFFICER (name, location, telephone no.): W. Chan

Air Resources Branch

OBJECTIVE(S): To develop a method for accurate sampling of airborne PAH  
compounds on a routine basis.

PROJECT DESCRIPTION: This is a joint ARB-LSB-Regional Offices project.  
Various methods are being evaluated by both laboratory and field testing, with  
a view to possible interferences, accuracy and precision.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	60.0			60.0
	Work Years:	0.5			0.5

Budget Source: ARB Internal

KEYWORDS: PAH, ambient air

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Method Development for Volatile  
Organics in Ambient Air

PROJECT NO: ARB  
START DATE: 03/82

SHORT TITLE: VOC Development

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Mr. P. Steer  
Air Resources Branch  
880 Bay Street  
Toronto, 965-4081

LIAISON OFFICER (name, location, telephone no.): W. Chan

Air Resources Branch

OBJECTIVE(S): To develop a method for accurate sampling of volatile organic compounds on a routine basis.

PROJECT DESCRIPTION: This is a joint ARB-LSB-Regional Offices project. The use of ambient cartridges and other sampling approaches is being evaluated by both laboratory and field testing, with a view to possible interferences, accuracy and precision.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	50.0			50.0
	Work Years:	0.5			0.5

Budget Source: ARB

KEYWORDS: Volatile toxic organic compounds

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Analysis of Volatile Organics in Air PROJECT NO: ARB  
START DATE:

SHORT TITLE: Airborne Volatile Organics

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. E. Singer  
Air Resources Branch  
880 Bay Street  
Toronto, 965-4081

LIAISON OFFICER (name, location, telephone no.): Dr. M. Lusic  
Air Resources Branch

OBJECTIVE(S): Positive identification and quantitation of trace organic compounds (polar and non polar) in the range of  $C_2 - C_{12}$  in air. Sampling, standards, analysis, etc.

PROJECT DESCRIPTION: Methods of sampling (canisters, cartridges) preservation, analysis (GC; GC<sup>2</sup>; GC/MS; GC/MI FTIR, etc.), positive identification and standards for analysis.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	300.0	350.0	400.0	1,050.0
	Work Years:				

Budget Source: ARB

KEYWORDS: Volatile organic compounds, trace organics, air analysis

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Lab Services Branch

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: TAGA 3000 and 6000

PROJECT NO: ARB  
START DATE:

SHORT TITLE: Trace Organic Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Mr. G. DeBrou  
Air Resources Branch  
880 Bay Street  
Toronto,

LIAISON OFFICER (name, location, telephone no.): Dr. E. Singer  
Air Resources Branch

OBJECTIVE(S): To develop methods of monitoring of trace organics in air, soil, etc. by CI/MS; CI/MS/MS; GC/CI MS/MS, etc.

PROJECT DESCRIPTION: Investigate the ion chemistry of trace organics, formation of a library, computerized operation and other techniques associated with the operation of CI/MS; MS/MS and GC/MS/MS.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		400.0	450.0	500.0	1,350.0

Work Years:

Budget Source: ARB

KEYWORDS: MS/MS, Tandem mass spec, ion chemistry, CI/MS

OUTPUT (papers, presentations, reports): Several Technology Transfer Conference and other similar conferences. See G. DeBrou for details.

EXTERNAL PARTICIPATION (ministries, governments, agencies): LSB, SCIEX, etc.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

HAZARDOUS CONTAMINANTS BRANCH PROJECTS

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## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Persistence, Leaching and  
Bioavailability of Inorganic and Pentachlorophenol  
Wood Preservatives

PROJECT NO: PO#A04809  
START DATE: 01/88

SHORT TITLE: Wood Preservatives

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. K. Solomon  
Canadian Centre for  
Toxicology

LIAISON OFFICER (name, location, telephone no.): G. Cutten

Hazardous Contaminants Branch  
323-5117

OBJECTIVE(S): Study the potential human exposure and ecological importance of the potential dislodgeability of residues of PCP and inorganic preservatives.

PROJECT DESCRIPTION: The project will cover several priorities:

1. Leaching from treated lumber into water of inorganics and effect of acid precipitation on leaching into water.
2. Leaching of PCP from treated wood and movement in soil.
3. Aquatic toxicology of leachates and individual components.
4. Human bystander exposure to PCP leachates.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	10.2	32.5	34.4	77.1
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Work Years:

Budget Source: Hazardous Contaminants Branch

**KEYWORDS:** wood preservatives, inorganic, PCP, pentachlorophenol, bystander exposure

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

LABORATORY SERVICES BRANCH PROJECTS

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RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL E  
INTERNAL

Contract C  
Grant

Solicited S  
Unsolicited

PROJECT TITLE: Method Development for Aqueous  
Volatile Halocarbons Analysis at the Parts Per  
Trillion Level

PROJECT NO: DWO-E-87-03  
START DATE: 87/05/01

SHORT TITLE: Volatile Halocarbons-PPT

PRINCIPAL INVESTIGATOR AND AFFILIATION : Cecelia Chan  
Mann Testing Labs Limited 5550 McAdam Road  
Mississauga, Ontario  
L4Z 1P1  
416-890-2555  
LIAISON OFFICER (name, location, telephone): Dr. O. William Berg  
Lab Services Branch DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5907

OBJECTIVES: To develop methodology for the quantitative routine analysis of  
ambient water for volatile halocarbon compounds in the low parts per  
trillion (w/w) range.

PROJECT DESCRIPTION : This method is to be developed with the Perkin-Elmer  
ATD-50 and its associated gas chromatograph equipped with an electron capture  
detector. The lower detection limits will improve determination of the  
mobility of these compounds, the dilution effect, and the distribution of  
these compounds.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (\$000's):		\$30.00	\$15.00	\$0.00	\$45.00
Work Years:		0.30	0.30	0.00	0.60

Budget Source: LSB

KEYWORDS: Analysis, Halocarbons, Aqueous, Low Level

OUTPUT (papers, presentations, reports): Internal Report, External Publication

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract	Solicited
INTERNAL I	Grant	Unsolicited

PROJECT TITLE: Flow Injection Analysis System for ICP/OES

PROJECT NO: ITC-I-88-16  
START DATE: 88/04/01

SHORT TITLE: Flow Injection Analysis - ICP/OES

PRINCIPAL INVESTIGATOR AND AFFILIATION : F. Hopper / F. Mo  
Lab Service Branch ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5852

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To develop and evaluate a flow injection system for the JY48 Spectrometer.

PROJECT DESCRIPTION : A flow injection system will be added to the JY48 spectrometer and interfaced to the instrument controller. Expected benefits include increased sample through-put, automatic sample introduction, reduced operator time, and automatic dilution of over-range samples.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (\$000's):	\$30.00	\$0.00	\$0.00	\$30.00
	Work Years:	0.30	0.00	0.00	0.30

Budget Source: LSB

KEYWORDS: Flow Injection Analysis, ICP/OES

OUTPUT (papers,presentations,reports): Internal report, paper for publication or presentation.

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: This system will decrease the per sample analysis time while simultaneously expanding the dynamic range of the instrument by 1-2 orders of magnitude.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Development of an Ultrasonic  
Nebulizer ICP/OES Method for the Analysis of  
Surface Waters.

PROJECT NO: ITC-I-88-17  
START DATE: 88/04/01

SHORT TITLE: Ultrasonic Nebulizer ICP/OES

PRINCIPAL INVESTIGATOR AND AFFILIATION : Boomer/Hopper/Tymkewycz  
Lab Services Branch ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5858

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To develop a method for the analysis of surface waters directly  
with no preconcentration.

PROJECT DESCRIPTION : An ultrasonic nebulizer will be added to the Atomcomp  
spectrometer. Surface water samples will be analyzed using the system and  
results compared with the present preconcentration method. Expected benefit  
of ultrasonic nebulizer system is improved sample throughput due to  
elimination of the preconcentration step.

BUDGET AND	Year: (* current)	1 *	2	3	TOTAL
RESOURCES:					
	Cost: (\$000's):	\$45.00	\$0.00	\$0.00	\$45.00
	Work Years:	0.10	0.00	0.00	0.10
Budget Source: LSB					

KEYWORDS: ICP, Water Analysis, Emission Spectroscopy, Ultrasonic Nebulizer

OUTPUT (papers, presentations, reports): Internal report, paper for  
publication and presentation.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract	Solicited
INTERNAL I	Grant	Unsolicited

PROJECT TITLE: Application of Robotics to Microwave Digestion of Vegetation and Soil Samples for Analysis of Metals

PROJECT NO: ITC-I-87-08  
START DATE: 87/05/01

SHORT TITLE: Microwave Digestion Robotics

PRINCIPAL INVESTIGATOR AND AFFILIATION : Elizabeth Pastorek  
Lab Services Branch ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5855

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To apply a robotic system to a microwave digestion technique for vegetation and soil sample preparation for metal analysis.

PROJECT DESCRIPTION : A robotic system will be set up to interact with a microwave oven by weighing samples, dispensing acids, placing samples into and taking them out of the oven. The computer component will register sample weights for calculation of final concentration of metals present. Time savings should result, parameters will be developed on the microwave system that will digest both soil and vegetation matrices. Results of analysis for heavy metals must match present method. QA/QC protocols will be established and a report produced.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$136.00	\$20.00	\$0.00	\$156.00
	Work Years:	1.10	0.30	0.00	1.40*

Budget Source: LSB

KEYWORDS: Robotics, Vegetation, Soil, Microwave, Metals

OUTPUT (papers, presentations, reports): Internal and external reports.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: 18K was funded by the Federal Government in the first year.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract	Solicited
INTERNAL I	Grant	Unsolicited

PROJECT TITLE: Development of Carbon Fibre Clean-up of Biota for the Analysis of Dioxins/ Furans	PROJECT NO: DWO-I-87-04 START DATE: 86/10/01
--	---

SHORT TITLE: Carbon Fibre Clean-up of Biota for Dioxins/Furans

PRINCIPAL INVESTIGATOR AND AFFILIATION :	Colleen Tashiro
Lab Services Branch	DWO Section 125 Resources Road Rexdale, Ontario 416-235-5897

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: The study includes two phases:  
Phase I - Develop improved fish cleanup based on carbon adsorbents  
Phase II - Automate cleanup to allow overnight sample processing

PROJECT DESCRIPTION : I. Investigate the use of carbon fibre as adsorbents for the cleanup of fish tissue to improve recovery of dioxins and furans.  
II. After the optimization of Phase I, the method will be automated by the use of robotics to allow increased sample throughput.

BUDGET AND	Year: (* current)	1	2 *	3	TOTAL
RESOURCES:	Cost: (\$000's):	\$34.00	\$25.00	\$0.00	\$59.00
	Work Years:	0.70	0.40	0.00	1.10

Budget Source: LSB

KEYWORDS: Dioxin, Automated Cleanup

OUTPUT (papers, presentations, reports): Report, Journal publication

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Work initiated to support Water Resources Branch - Fish Contaminants Program. Results should be applicable to other sample types.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract	Solicited
INTERNAL I	Grant	Unsolicited

PROJECT TITLE: Stability Study of Chlorinated Dibenzo-p-dioxins and Dibenzofurans in Fish During Storage PROJECT NO: DWO-I-87-03 START DATE: 87/01/01

SHORT TITLE: Dioxins/Furans in Stored Fish Samples

PRINCIPAL INVESTIGATOR AND AFFILIATION : David Schellenberg  
Lab Services Branch DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5894

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To determine the effect of freezer storage time on analytical results.

PROJECT DESCRIPTION : Up to two years or more can elapse before ground fish samples are analyzed. This study is needed to determine whether the analytical results obtained are consistent over this time period.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$21.00	\$10.00	\$0.00	\$31.00
	Work Years:	0.50	0.20	0.00	0.70

Budget Source: LSB

KEYWORDS: Fish, Storage, Dioxin

OUTPUT (papers, presentations, reports): Paper

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Work is required to support Water Resources Branch - Fish Contaminants Program. Samples have been stored for two years. Extracted samples will be analyzed by August, 1988. Report to be completed by November, 1988.



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Identification of Unknown Organic Contaminants by High Resolution Mass Spectrometry (HRMS) PROJECT NO: DWO-I-87-12  
START DATE: 87/03/01

SHORT TITLE: Unknown Organic Contaminants - HRMS

PRINCIPAL INVESTIGATOR AND AFFILIATION : Dr. Eric Reiner  
Lab Services Branch DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5903

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To identify unknown organic environmental contaminants using high resolution mass spectrometric techniques.

PROJECT DESCRIPTION : Use advanced instrumentation (ZAB-2F) to identify organic environmental contaminants not analyzable by conventional low resolution mass spectrometric techniques. Advanced mass spectrometric techniques including high resolution MS (accurate mass determinations), Mass spectrometry-Mass spectrometry (MS-MS), linked scanning and Mass Analyzed Ion Kinetic Spectrum (MIKES) will be employed.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$48.00	\$30.00	\$0.00	\$78.00
	Work Years:	1.00	0.50	0.00	1.50*

Budget Source: LSB

KEYWORDS: Compound Identification, High Resolution, Mass Spectrometry

OUTPUT (papers, presentations, reports): One presentation has been given at the Technology Transfer Conference.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: HRMS full scans, accurate mass (elemental composition) determination, linked scans and MIKES have been used to identify unknowns by GC/MS.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Investigation of Volatiles Loss/  
Degradation in Fish/Sediment During Storage

PROJECT NO: DWO-I-87-07  
START DATE: 87/07/01

SHORT TITLE: Volatiles Loss in Stored Fish/Sediment Samples

PRINCIPAL INVESTIGATOR AND AFFILIATION :  
Lab Services Branch

Steve Jenkins  
DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5903

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To determine volatile organics loss in prepared fish tissue and sediment, stored at sub-0 degree temperature over various time periods.

PROJECT DESCRIPTION : Fish will be prepared by present protocol. The blended tissue will be divided into sub-samples of approx. 10g. each and stored in glass vials (with teflon/silicone liners) at sub-0 degree levels. At various time periods (i.e. 0 day, 1 day, 1 week, 2 week, 3 week, 5 week, 10 week), the tissue will be analyzed by purge + trap gas chromatography-mass spectrometry. The change in the chromatographic fingerprint will be analyzed.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (\$000's):		\$29.00	\$20.00	\$0.00	\$49.00
Work Years:		0.60	0.40	0.00	1.00**

Budget Source: LSB

KEYWORDS: Volatiles, Fish, Sediment, Storage

OUTPUT (papers, presentations, reports): Report, journal publication.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Sampling performed by staff of Water Resources Branch, Ministry of Environment.

COMMENTS: Results are required for interpretation of data generated by the Water Resources Branch programs. Study is one third completed.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Development of a Method for  
Analysis of 2,4- and 2,6- Dinitrotoluene in  
Surface and Drinking Waters

PROJECT NO: DWO-I-88-03  
START DATE: 88/04/01

SHORT TITLE: 2,4- and 2,6- Dinitrotoluene in Water Samples

PRINCIPAL INVESTIGATOR AND AFFILIATION : Patrick Crozier  
Lab Services Branch DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5911

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To enable the Ministry to analyze water samples for  
2,4- dinitrotoluene at 100 ppt and 2,6- dinitrotoluene at 10 ppt.

PROJECT DESCRIPTION : The project will involve the following:

- 1) optimizing the cleanup procedure
- 2) determining best G.C. detectors and programs
- 3) linearity studies
- 4) reproducibility checks to obtain W and T

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (\$000's):	\$20.00	\$0.00	\$0.00	\$20.00
	Work Years:	0.40	0.00	0.00	0.40
Budget Source: LSB					

KEYWORDS: Dinitrotoluene, Water Samples

OUTPUT (papers,presentations,reports): Report

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract	Solicited
INTERNAL I	Grant	Unsolicited

PROJECT TITLE: Derivatization of Acid  
Extractables using Phase Transfer Reagents

PROJECT NO: DWO-I-88-02  
START DATE: 88/05/01

SHORT TITLE: Acid Extractables by Phase Transfer Reagents

PRINCIPAL INVESTIGATOR AND AFFILIATION : Dr.V.Taguchi/Dr.O.W.Berg  
Lab Services Branch DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5902

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: Improved method for analysis of acid extractables by GC-MS.

PROJECT DESCRIPTION : 1. Derivatization (methylation) of acid extractables by phase transfer catalysis should result in the formation of stable derivatives. 2. These stable derivatives should have superior GC characteristics resulting in increased selectivity and sensitivity. 3. Spiked water samples will be analyzed by GC-FID and confirmed by GC-MS. 4. Optimization and validation studies will be undertaken to bring the method on line.

BUDGET AND	Year: (* current)	1 *	2	3	TOTAL
RESOURCES:	Cost: (\$000's):	\$20.00	\$0.00	\$0.00	\$20.00
	Work Years:	0.40	0.00	0.00	0.40

Budget Source: LSB

KEYWORDS: Derivatization, Acid Extractables, Phase Transfer Catalysis

OUTPUT (papers,presentations,reports): Presentation at the Technology Transfer Conference in December, 1988.

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Comparison of Mass Spectral  
Instrumental Capabilities for Determination  
of Chlorinated Dioxin/Furan Analysis

PROJECT NO: DWO-I-87-02  
START DATE: 87/04/01

SHORT TITLE: Mass Spectral Instrumental Capabilities

PRINCIPAL INVESTIGATOR AND AFFILIATION : Donna McCurvin  
Lab Services Branch DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5892

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To compare High Resolution Mass Spectrometer, Low Resolution  
Mass Spectrometer (MSD Finnigan 4500) and MS-MS capability for dioxin/furan  
determination.

PROJECT DESCRIPTION : Instrument detection limits, linear dynamic range, and  
freedom from interferences for various sample types will be investigated.  
It is planned to define the degree of chemical work-up and type of  
instrumentation needed for special applications.

BUDGET AND	Year: (* current)	1	2 *	3	TOTAL
RESOURCES:					
	Cost: (\$000's):	\$25.00	\$15.00	\$0.00	\$40.00
	Work Years:	0.50	0.20	0.00	0.70*

Budget Source: LSB

KEYWORDS: Mass Spectrometry, Detection Limit, Dynamic Range, Dioxin,  
Furan

OUTPUT (papers,presentations,reports): Journal publication.

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: A variety of Gas Chromatography - Mass Spectrometry equipment and  
techniques are available for chlorinated dioxin/furan determination. This  
work is required to define the data characteristics of each technique and to  
determine the intercomparability of results. Report planned by August, 1988.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Investigation of the Use of MS/MS for Rapid Dioxin/Furan Determination

PROJECT NO: DWO-I-88-01  
START DATE: 88/04/01

SHORT TITLE: MS/MS for Rapid Dioxin/Furan Determination

PRINCIPAL INVESTIGATOR AND AFFILIATION : Dr. Eric Reiner  
Lab Services Branch DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5903

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To achieve more rapid dioxin/furan determinations in complex samples using the instrumental technique of tandem mass spectrometry (MS-MS), by requiring reduced cleanup.

PROJECT DESCRIPTION : Complex sample types such as fish, pulp and paper sludges and others will be extracted and brought to various degrees of cleanup. By analyzing these samples by MS-MS and comparing results with those of fully cleaned-up samples, the degree of cleanup required will be determined. Standard methods for reduced clean-up, rapid determination of CDDs/CDFs in samples will be developed.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (\$000's):	\$40.00	\$0.00	\$0.00	\$40.00
	Work Years:	0.60	0.00	0.00	0.60

Budget Source: LSB

KEYWORDS: Dioxins, Furans, MS-MS, Reduced cleanup

OUTPUT (papers, presentations, reports): Reports, journal papers.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Tracer Studies Using ICP/MS  
Isotope Ratios: Air Particulate

PROJECT NO: ITC-I-87-01  
START DATE: 86/04/01

SHORT TITLE: ICP/MS Isotope Ratios

PRINCIPAL INVESTIGATOR AND AFFILIATION : David Boomer  
Lab Services Branch ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5858

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To investigate the feasibility of using isotope ratios to identify and discriminate various sources of pollution.

PROJECT DESCRIPTION : A method has been developed for the analysis of air particulate. Pb206/207 ratios have been measured in a group of samples from Dorset, Ontario. The isotope ratios correlate with air mass trajectories and this information was used to identify the probable sources of the pollution.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
	Cost: (\$000's):	\$27.00	\$27.00	\$4.00	\$58.00
	Work Years:	0.10	0.10	0.10	0.30*

Budget Source: LSB

KEYWORDS: ICP/MS Isotope Ratios, Air Particulate

OUTPUT (papers,presentations,reports): Presentations at AOAC Ottawa and TCS/Toronto/Muskoka and by L. Barrie.

EXTERNAL PARTICIPATION (ministries,governments,agencies): Len Barrie

COMMENTS: This technique will become useful in LRTAP and APIOS work.



EXTERNAL	RESEARCH AND TECHNOLOGY INVENTORY: 1988	Contract	Solicited
INTERNAL I		Grant	Unsolicited

PROJECT TITLE: Development of Methods for Technicon TRAAC Colourimetric System	PROJECT NO: WQ-I-87-03 START DATE: 87/04/01
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SHORT TITLE: Colourimetric Methods

PRINCIPAL INVESTIGATOR AND AFFILIATION :	Michael Rawlings
Lab Services Branch	WQ Section
	125 Resources Road
	Rexdale, Ontario
	416-235-5880

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To develop 15 colourimetric methods using the latest hardware and state-of-the-art techniques for continuous flow systems.

PROJECT DESCRIPTION : The reagent concentrations, time, and mixing parameters from the existing AutoAnalyzer II methods will be recalculated to suit the TRAACS 800 hydraulics. A suitable manifold will be built and tested. Several runs of samples over several days will be intercompared.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$18.00	\$4.50	\$0.00	\$22.50
	Work Years:	0.20	0.10	0.00	0.30

Budget Source: LSB

KEYWORDS: TRAAC, Technicon, Colourimetric, Methods

OUTPUT (papers, presentations, reports): Internal method documentation, both HAMES & Bench, with revised Q.C. protocols.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Technical advice will be available from Technicon International Canada Ltd.

COMMENTS: Most modules are available for the TRAAC System but there are problems with the sampler. Software compatible with DBase III+ is not yet available. Until hardware and software are complete, development work is on hold.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Robotics for Dissolved Oxygen Measurement in the Biochemical Oxygen Demand Test (BOD TEST) PROJECT NO: WQ-I-87-01 START DATE: 87/03/01

SHORT TITLE: Robotics for Dissolved Oxygen

PRINCIPAL INVESTIGATOR AND AFFILIATION : Peter Campbell  
Lab Services Branch WQ Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5872

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To automate the measurements of oxygen concentration required on the first and fifth day of the BOD test.

PROJECT DESCRIPTION : Purchase robotic hardware and software to enable unattended oxygen readings and data collection. Occasional attention will be required to change sample bottles in racks. The major difficulty is minimizing the time for each reading since more than 600 readings may be required per day.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (\$000's):		\$27.00	\$9.00	\$0.00	\$36.00
Work Years:		0.20	0.10	0.00	0.30

Budget Source: LSB

KEYWORDS: Robotics, Oxygen, Measurement, BOD

OUTPUT (papers,presentations,reports): Internal method documentation on completion.

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: Data manipulation and electrode calibration problems have slowed the progress in automating part of the BOD test. Most operations in the lab have to be modified to work effectively with the robot.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Robotics for Weight Measurement  
in the Solids Test

PROJECT NO: WQ-I-87-02  
START DATE: 87/03/01

SHORT TITLE: Robotics for Solids Weight Measurement

PRINCIPAL INVESTIGATOR AND AFFILIATION : Peter Campbell  
Lab Services Branch WQ Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5872

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To automate the measurement of weights of filters and dishes containing dried residue from environmental samples. Initial tare weight measurement will also be automated.

PROJECT DESCRIPTION : Purchase robotic hardware and software to enable unattended weighing on microbalance, and data collection. Occasional attention will be required to change racks of filters or dishes. The major difficulty is minimizing the time required for each reading, since more than 2,000 readings may be required per week.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$3.00	\$5.00	\$8.00	\$16.00
	Work Years:	0.10	0.10	0.10	0.30

Budget Source: LSB

KEYWORDS: Robotics, Weight, Measurement, Solids

OUTPUT (papers,presentations,reports): Internal method documentation on completion.

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: The project is still in the planning stage but most equipment is delivered. Racks need to be redesigned and the software written to accommodate the operational procedures and equipment within the working radius.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Robotics for Sub-Aliquoting  
Station for Inorganic Tests

PROJECT NO: WQ-I-87-04  
START DATE: 87/09/01

SHORT TITLE: Robotics for Sub-Aliquoting

PRINCIPAL INVESTIGATOR AND AFFILIATION : Walter Wright  
Lab Services Branch WQ Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5879

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To prepare multiple aliquots of samples which are suitable for Water Quality Section (WQS) work stations and which are accompanied by identifiers suitable for LIS operations.

PROJECT DESCRIPTION : Based on an initial feasibility study by an outside consultant, a design for a robotic station will be developed.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$58.00	\$24.00	\$38.00	\$120.00
	Work Years:	0.20	0.10	0.20	0.50

Budget Source: LSB

KEYWORDS: Robotics, Aliquoting, Inorganic

OUTPUT (papers, presentations, reports): Reports

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Development of aliquoting station has been slower than anticipated because of staff changes and the complexity of the system.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL		Contract	Solicited
INTERNAL	I	Grant	Unsolicited

PROJECT TITLE: Flow Injection Analysis System For ICP/MS

PROJECT NO: ITC-I-88-15  
START DATE: 88/04/01

SHORT TITLE: Flow Injection for ICP/MS

PRINCIPAL INVESTIGATOR AND AFFILIATION : D. Boomer / F. Hopper  
Lab Services Branch ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5858

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To develop and evaluate a flow injection system for the Sciex Elan ICP/MS.

PROJECT DESCRIPTION : A flow injection system will be developed for use with the Sciex Elan ICP/MS. This sample introduction system will reduce matrix effects and expand the sensitivity and dynamic range of the instrument.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (\$000's):	\$30.00	\$0.00	\$0.00	\$30.00
	Work Years:	0.30	0.00	0.00	0.30*

Budget Source: LSB

KEYWORDS: Flow Injection Analysis ,ICP/MS

OUTPUT (papers,presentations,reports): Paper to be presented at Spectroscopy Conference (Ottawa, August, 1988).

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: The increased sensitivity will be of use in LRTAP studies and to ARB and WRB for surveys and tracer studies.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL

Contract

Solicited

INTERNAL I

Grant

Unsolicited

PROJECT TITLE: Determination of Arsenic, Selenium and Antimony in Environmental Matrices by Flow Injection Analyzer - Hydride FAAS Techniques

PROJECT NO: ITC-I-87-02  
START DATE: 88/06/01

SHORT TITLE: FIA-Hydride FAAS

PRINCIPAL INVESTIGATOR AND AFFILIATION : Ram Sadana  
Lab Services Branch ITC Section  
125 REsources Road  
Rexdale, Ontario  
416-235-5861

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To develop a routine semi-automated method for the determination of arsenic, selenium and antimony at ultra-trace concentrations in environmental samples.

PROJECT DESCRIPTION : To develop a fast routine method for the determination of arsenic, selenium and antimony in environmental matrices by interfacing FIA with the Hydride Flameless Atomic Absorption Spectrophotometer (FAAS). Low detection limits will be achieved and will assist the client groups in establishing background levels of the above elements.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (\$000's):	\$15.00	\$0.00	\$0.00	\$15.00
	Work Years:	0.20	0.00	0.00	0.20

Budget Source: LSB

KEYWORDS: Arsenic, Selenium, Antimony, FIA, Hydride FAAS

OUTPUT (papers, presentations, reports): Internal report.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Development of Methods for the  
Determination of Electroactive Species such as  
Cyanide and Sulfide by Ion Chromatography.

PROJECT NO: ITC-I-87-14  
START DATE: 87/06/01

SHORT TITLE: Cyanide and Sulfide by Ion Chromatography

PRINCIPAL INVESTIGATOR AND AFFILIATION : Dr. Jerold Hipfner  
Lab Services Branch ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5856

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To develop working methods for the determination of  
electroactive species such as cyanide and sulfide in environmental samples by  
ion chromatography.

PROJECT DESCRIPTION : Published techniques for the determination of  
electroactive species such as cyanide and sulfide by electrochemical  
detection and ion chromatography will be rigorously investigated to develop  
working methods for these two ions in particular. The investigation will  
include a study of all flow and separation parameters such as pH and eluant  
composition as well as optimum reduction voltages.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$2.00	\$23.00	\$0.00	\$25.00
	Work Years:	0.00	0.20	0.00	0.20

Budget Source: LSB

KEYWORDS: Ion Chromatography, Cyanide, Sulfide

OUTPUT (papers, presentations, reports): Analytical method changes, potential  
paper.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: The Application of Robotics for the Digestion of Fish Samples for Mercury Analysis PROJECT NO: ITC-I-87-03  
START DATE: 87/06/01

SHORT TITLE: Robotics for Fish Digestion for Mercury

PRINCIPAL INVESTIGATOR AND AFFILIATION : Ram Sadana  
Lab Services Branch ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5861

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To develop an automated fish digestion procedure by using robotics.

PROJECT DESCRIPTION : To develop an automated sample digestion procedure for biomaterials using robotics. It will shorten turnaround time for mercury analysis, thus achieving higher productivity.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (\$000's):		\$80.00	\$15.00	\$0.00	\$95.00
Work Years:		0.00	0.30	0.00	0.30

Budget Source: LSB

KEYWORDS: Fish, Mercury, Digestion, Robotics

OUTPUT (papers, presentations, reports): External publication.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Evaluation of Modified Hi-vols for PAH Analysis  
PROJECT NO: TO-I-87-09  
START DATE: 86/06/01

SHORT TITLE: Modified Hi-vols for PAHS

PRINCIPAL INVESTIGATOR AND AFFILIATION : Steve Burns  
Lab Services Branch  
TO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5758

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: 1. Method validation  
2. Implementation for routine operations  
3. Provision of accurate QC/QA information.

PROJECT DESCRIPTION : Standard Hi-vol units were modified to accept an adsorbent field cartridge. The cartridges after exposure were extracted, cleaned up and analysed for a range of PAHs to determine the effects of ozone removal and artifact formation.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
Cost: (\$000's):		\$48.00	\$48.00	\$0.00	\$96.00
Work Years:		0.50	0.50	0.00	1.00

Budget Source: LSB

KEYWORDS: PAH, Hi-vol

OUTPUT (papers, presentations, reports): Report - in conjunction with the Air Resources Branch.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: 8K was funded by the Federal Government in the first year.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Routine Method for Analysis of  
Resin and Fatty Acids for the Pulp and Paper  
Industry

PROJECT NO: TO-I-87-13  
START DATE: 87/03/01

SHORT TITLE: Resin and Fatty Acids Method Development

PRINCIPAL INVESTIGATOR AND AFFILIATION : Roxana Lega  
Lab Services Branch TO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5756

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: To provide a routine method for the analysis of resin and fatty acids, targeting on the parameters required for MISA Paper and Pulp industry.

PROJECT DESCRIPTION : A method provided by Dr. Voss from Paprican will be adjusted and developed to provide a routine method for the analysis of fatty and resin acids in MOE labs. The presently available automated G.C. - auto samplers, tumblers etc. will be used and the requested client detection limits will be applied.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$21.00	\$5.00	\$0.00	\$26.00
	Work Years:	0.15	0.10	0.00	0.25

Budget Source: LSB

KEYWORDS: Resin Fatty Acids/Pulp & Paper

OUTPUT (papers, presentations, reports): Method to be published by Analytical Group of Pulp & Paper Technical Committee.

EXTERNAL PARTICIPATION (ministries, governments, agencies): Pulp & Paper Research Institute of Canada, Quebec; E.P.S., Burlington, Ontario.

COMMENTS: 8K was funded by Federal Government in the first year.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Broad Range Screening Method For  
Phenol Speciation

PROJECT NO: TO-I-87-12  
START DATE: 87/04/01

SHORT TITLE: Broad Range Screening - Phenols

PRINCIPAL INVESTIGATOR AND AFFILIATION :  
Lab Services Branch

Roxana Lega  
TO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5756

LIAISON OFFICER (name,location,telephone):

OBJECTIVES: To provide a gas chromatographic analytical method for the analyses of a broad range of phenols, catechols, guaicolis found in pulp and paper industry effluents.

PROJECT DESCRIPTION : Method consists of dual FID/EC method to simultaneously analyse chlorinated and non-chlorinated speciated phenols. After a preliminary extraction and derivatization, the extracts are submitted to gas chromatography.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$21.00	\$20.50	\$0.00	\$41.50
	Work Years:	0.15	0.30	0.00	0.45
Budget Source: LSB					

KEYWORDS: Phenols, Guaicolis, Catechols

OUTPUT (papers,presentations,reports): Internal report.

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: 8K was funded by the Federal Government in the first year.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL I

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Measurement of Deposition of  
Organic Compounds due to Long Range Transport of  
Pollutants

PROJECT NO: TO-I-87-10  
START DATE: 86/07/01

SHORT TITLE: Long Range Transport of Organics

PRINCIPAL INVESTIGATOR AND AFFILIATION : Steve Burns  
Lab Services Branch TO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5758

LIAISON OFFICER (name, location, telephone):

OBJECTIVES: 1. Method validation  
2. Implementation for routine operations  
3. Provision of QC/QA data  
4. Paper/report presentation.

PROJECT DESCRIPTION : Ambient air and precipitation samples will be taken at selected Great Lakes locations and analysed for a range of chlorinated organics (PCB, DDT, Toxaphene), to determine the loading due to atmospheric deposition. Method will entail analyses in the sub ppt range.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
Cost: (\$000's):		\$60.00	\$105.00	\$12.00	\$177.00
Work Years:		1.00	2.00	0.30	3.30

Budget Source: LSB

KEYWORDS: Long Range Atmospheric Deposition, PCB, DDT, Toxaphene

OUTPUT (papers, presentations, reports): Paper/report to be prepared in conjunction with the Air Resources Branch.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL E  
INTERNAL

Contract C  
Grant

Solicited S  
Unsolicited

PROJECT TITLE: ICP/MS Analytical Development,  
Interface of ICP/OES with ICP/MS

PROJECT NO: ITC-E-87-02  
START DATE: 87/01/01

SHORT TITLE: ICP/MS Analytical Development

PRINCIPAL INVESTIGATOR AND AFFILIATION :  
McMaster University

Dr. B. McNutt  
Department of Geology  
Hamilton, Ontario

LIAISON OFFICER (name, location, telephone):  
Lab Services Branch

416-525-9140  
David Boomer  
ITC Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5858

OBJECTIVES: To investigate the analytical capabilities of the ICP/MS with  
emphasis on environmental analysis.

PROJECT DESCRIPTION : Various aspects of the instrumentation will be  
investigated and developed. Project items include optimization of  
analytical conditions using simplex techniques, investigation of negative  
ion capability for determination of negative ions (sulfur and halogens)  
and application to tracer analysis and source allocation in precipitation  
samples; and optical, ICP/MS interface to determine added elements.

BUDGET AND RESOURCES:	Year: (* current)	1	2 *	3	TOTAL
	Cost: (\$000's):	\$55.83	\$56.44	\$37.73	\$150.00
	Work Years:	0.00	0.00	0.00	0.00

Budget Source: LSB

KEYWORDS: ICP/MS, ICP/OES, Optimization

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This study is part of the Laboratory/University Joint  
Research Venture Program.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL E  
INTERNAL

Contract  
Grant G

Solicited S  
Unsolicited

PROJECT TITLE: Super Critical Fluid Extraction  
Development

PROJECT NO: TO-E-87-01  
START DATE: 88/03/01

SHORT TITLE: Super Critical Fluid

PRINCIPAL INVESTIGATOR AND AFFILIATION : Dr. Kruus/Dr. Wightman  
Carleton University Department of Chemistry  
Ottawa, Ontario  
KIS 5B6  
416-231-3630

LIAISON OFFICER (name,location,telephone): Dr. Ijaz Ahmad  
Lab Services Branch TO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5757

OBJECTIVES: To review and develop the application of super critical fluid  
extraction techniques for trace organics (volatile and non-volatile) in  
solid matrices.

PROJECT DESCRIPTION : MOE supplied supercritical extraction (SCE) unit to the  
project investigator. The project will represent the PHD work of Mr. Burke.  
The project will span 2 - 2 1/2 years and is intended to review, develop and  
provide an SCE technique for application in environmental analysis of  
volatile and non-volatile organics in soils, sediments and possibly  
vegetation and biota. To expand current areas of analysis for volatile or low  
extractability compounds.

BUDGET AND	Year: (* current)	1	2 *	3	TOTAL
RESOURCES:	Cost: (\$000's):	\$61.50	\$24.50	\$28.50	\$114.50
	Work Years:				

Budget Source: LSB

KEYWORDS: Super Critical Fluid Extraction

OUTPUT (papers,presentations,reports): PHD thesis, presentation on new  
research area, technology transfer presentation.

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: This project is part of the Lab/University Joint Research Venture  
Program.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL E	Contract C	Solicited
INTERNAL	Grant	Unsolicited U

PROJECT TITLE: Source Identification of Air Borne Particulates of Environmental Concern Using Surface and Microchemical Techniques

PROJECT NO: DWO-E-88-02  
START DATE: 88/08/17

SHORT TITLE: Source Identification of Air Particulates

PRINCIPAL INVESTIGATOR AND AFFILIATION : Dr. Ronald R. Martin  
University of Western Ont Department of Chemistry  
London, Ontario

LIAISON OFFICER (name,location,telephone): 519-679-2111  
Lab Services Branch Dr. J. Hipfner/R. Moody  
ITC Section  
125 Rexdale, Ontario  
Rexdale, Ontario  
416-235-5856

OBJECTIVES: To develop a series of instrumental tests which may be used to identify specific sources of airborne particulates. The environmental toxicity will also be assessed.

PROJECT DESCRIPTION : Project will provide MOE with an expanded capability for identification of air particulates relating to sources; has application toward complaint investigations and long range air transport of particulates. University of Western Ontario will be utilizing the resources of the Surface Science Centre which recieved funding recently by the Ontario Government as a Centre of Excellence. The work will be done by an MSc student who will work closely with LSB staff .

BUDGET AND	Year: (* current)	1 *	2	3	TOTAL
RESOURCES:	Cost: (\$000's):	\$33.20	\$36.60	\$38.10	\$107.90
	Work Years:	0.00	0.00	0.00	0.00

Budget Source: LSB

KEYWORDS: Air Borne Particulates, Characterization

OUTPUT (papers,presentations,reports): Report

EXTERNAL PARTICIPATION (ministries,governments,agencies):

COMMENTS: This project is part of the Lab/University Joint Research Venture Program.

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL E  
INTERNAL

Contract C  
Grant

Solicited  
Unsolicited U

PROJECT TITLE: Development of an Automated HPLC  
System for the Extraction and Determination  
of Multiresidues from Water Samples

PROJECT NO: DWO-E-88-01  
START DATE: 88/06/05

SHORT TITLE: Automated HPLC System for Multiresidues

PRINCIPAL INVESTIGATOR AND AFFILIATION : Dr. I. Brindle/Dr. Chiba  
Brock University Department of Chemistry  
St. Catharines, Ontario

L2S 3A1  
416-688-5550

LIAISON OFFICER (name, location, telephone):  
Lab Services Branch

Dr. David Hall  
DWO Section  
125 Resources Road  
Rexdale, Ontario  
416-235-5856

OBJECTIVES: To develop an automated High Pressure Liquid Chromatographic  
(HPLC) System method to replace the use of liquid/liquid extraction and  
improve the automation of solid phase extraction techniques for the analysis  
of organochlorine, carbonate, triazine and organophosphate compounds in  
water.

PROJECT DESCRIPTION : The project is intended to develop a HPLC to directly  
concentrate and separate various groups of organic parameters for analysis  
of surface waters. Such a system would eliminate the need for laborious  
extraction and concentration steps. The major groups which would be  
investigated include organochlorine pesticides and triazine herbicides. The  
work will be done by an MSc student who will work closely with LSB staff.

BUDGET AND RESOURCES:	Year: (* current)	1 *	2	3	TOTAL
	Cost: (\$000's):	\$98.62	\$40.47	\$15.36	\$154.45
	Work Years:	0.00	0.00	0.00	0.00

Budget Source: LSB

KEYWORDS: HPLC, Multiresidues

OUTPUT (papers, presentations, reports): Report

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This project is part of the Lab/University Joint Research Venture  
Program.



WASTE MANAGEMENT BRANCH PROJECTS

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RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	X	Contract		Solicited	
INTERNAL		Grant	X	Unsolicited	X

PROJECT TITLE: Demonstration of Proprietary  
Ultrafilter and Zero Discharge Rinsing on Recovery  
of Metal Finishing Wastes

PROJECT NO: IR-04-50  
START DATE: 06/88

SHORT TITLE: Recovery of Metal Finishing Wastes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Waste Management Consultants  
Wayne McLellan

LIAISON OFFICER (name, location, telephone no.): John Smart

Waste Management Branch  
323-5179

OBJECTIVE(S): To demonstrate effectiveness of equipment in metal recovery  
from wastes and treatment to allow in-plant re-use of wastes.

PROJECT DESCRIPTION: Equipment to be run on-site at several varied metal  
finishing companies.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	6.5	-	-	6.5
	Work Years:	0.5	-	-	0.5

Budget Source: Waste Management Branch - Industrial 4Rs Program

KEYWORDS: Demonstration; zero-discharge; ultrafilter.

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL    X                      Contract                      Solicited  
INTERNAL                      Grant                      Unsolicited    X

PROJECT TITLE: Recovery and Reuse of Phenol in  
Plastic Making Processes

PROJECT NO: IR-04-85  
START DATE: 07/88

SHORT TITLE: Phenol in Plastics

PRINCIPAL INVESTIGATOR AND AFFILIATION: Zenon Environmental for Durez  
Limited

LIAISON OFFICER (name, location, telephone no.): John Smart  
Waste Management Branch  
323-5179

OBJECTIVE(S): To investigate methods of reducing phenol use, and recovery of  
waste phenol for re-use in plastic manufacture.

PROJECT DESCRIPTION: Literature review of phenol recovery processes -  
application of information to plant situation.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	20	-	-	20
	Work Years:	0.5	-	-	0.5

Budget Source: Waste Management Branch Industrial 4Rs Program.

KEYWORDS: Phenol, Recovery from Wastewater, Re-use

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL    X                    Contract                    Solicited  
INTERNAL                    Grant        X                    Unsolicited    X

PROJECT TITLE: Evaluation of Thermal Screw Press                    PROJECT NO: IR-04-78  
in Multi Waste Recovery and Recycle                    START DATE: 07/88

SHORT TITLE: Thermal Screw Press

PRINCIPAL INVESTIGATOR AND AFFILIATION:                    Adam Boschieter  
   Spider Recycling

LIAISON OFFICER (name, location, telephone no.): John Smart  
   Waste Management Branch  
   323-5179

OBJECTIVE(S): To evaluate and demonstrate the thermal screw press in  
recovering and recycling different industrial wastes.

PROJECT DESCRIPTION: Wood, paper, wallboard, roofing tiles, rubber tires and  
other wastes will be treated to demonstrate the technical and economic  
viability of the process in recycling the wastes.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		134	-	-	134
Work Years:		0.5	-	-	0.5

Budget Source: Waste Management Branch Industrial 4Rs Program.

KEYWORDS: Screw Press - Waste Recycle.

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Recovery of Tin and Steel From  
Used Cans

PROJECT NO: IR-04-81  
START DATE: 07/88

SHORT TITLE: Tin and Steel Recovery

PRINCIPAL INVESTIGATOR AND AFFILIATION:

E. D. Rogers  
Metal Recovery Ind. Inc.

LIAISON OFFICER (name, location, telephone no.): John Smart

Waste Management Branch  
323-5179

OBJECTIVE(S): To determine means of segregating and preparing cans for  
integration into tin and steel recovery process.

PROJECT DESCRIPTION: Segregation, classification and cleaning used cans to  
render them suitable for treatment in existing process to recover tin and  
steel.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	48	-	-	48
	Work Years:	0.5	-	-	-

Budget Source: Waste Management Branch - Industrial 4Rs Program.

KEYWORDS: Tin, Steel, Cans, Recycling

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL    X                    Contract                    Solicited  
INTERNAL                    Grant        X                    Unsolicited        X

PROJECT TITLE: Use of Whey Wastes In Manufacture  
of High Grade Protein and Lactose

PROJECT NO: IR-04-20  
START DATE: 07/88

SHORT TITLE: Whey Wastes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Protose Separations Inc.  
Alan Jones

LIAISON OFFICER (name, location, telephone no.): John Smart

Waste Management Branch  
323-5179

OBJECTIVE(S): To investigate the manufacture of high grade protein and  
lactose from whey wastes at pilot scale.

PROJECT DESCRIPTION: Production of protein and lactose from whey wastes using  
continuous moving bed ion exchange technology.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		488	-	-	488
Work Years:		0.5	-	-	0.5

Budget Source: Waste Management Branch - Industrial 4Rs Program.

KEYWORDS: Whey waste; protein; lactose; ion exchange.

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL    X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited    X

PROJECT TITLE: Evaluation of Zero Discharge  
Technology For Tannery Operations

PROJECT NO: IR-04-75  
START DATE: 06/88

SHORT TITLE: Zero Discharge Technology

PRINCIPAL INVESTIGATOR AND AFFILIATION: G. Rupke Associates  
Gerry Rupke

LIAISON OFFICER (name, location, telephone no.): John Smart  
Waste Management Branch  
323-5179

OBJECTIVE(S): To evaluate state-of-the-art equipment and processes for  
minimization or elimination of tannery wastes by recycling and re-use of  
wastes.

PROJECT DESCRIPTION: Review of latest tannery processes and equipment for  
waste recovery - application of findings to actual case.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	16.7	-	-	16.7
	Work Years:	0.25	-	-	-

Budget Source: Waste Management Branch - Industrial 4Rs Program.

KEYWORDS: Tannery, waste recycle

OUTPUT (papers, presentations, reports): Report.

EXTERNAL PARTICIPATION (ministries, governments, agencies): None.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: A Guide for the Evaluation of Long-Term Leachability of Solidified Wastes

PROJECT NO: 339-RR  
START DATE: 11/87

SHORT TITLE: Long-term leachability of solidified wastes

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. P. Coté  
W.T.C.  
Environment Canada

LIAISON OFFICER (name, location, telephone no.): R. Khettry

Waste Management Branch  
323-5226

OBJECTIVE(S): Guidance for selection of leaching test method based on expected leaching scenario. Protection of groundwater quality.

PROJECT DESCRIPTION: Data collection, development of database, review of leaching tests, review of waste form properties, review of field conditions and investigations methods, development of generic long-term leaching scenarios, development of leaching evaluation procedure.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	70.0	70.0		140.0
	Work Years:	3.5			3.5

Budget Source: WMB (MOE) \$35,000 Remainder from USEPA, Env. Canada

KEYWORDS: (Long term) leachability, solidified wastes

OUTPUT (papers, presentations, reports): Leachability - Test procedure, waste form properties, leachability evaluation protocol, database of documents

EXTERNAL PARTICIPATION (ministries, governments, agencies): USEPA, Env. Canada (WTC)

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X Contract X Solicited X  
INTERNAL Grant Unsolicited

PROJECT TITLE: Development of a Laboratory  
Qualification Standard (Code) for Laboratories  
Analyzing Industrial Wastes

PROJECT NO: PO#A94386  
START DATE: 08/86

SHORT TITLE: Laboratory Qualification Code

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Canadian Standards Assc.  
Mr. Jim Dixon  
178 Rexdale Boulevard  
Rexdale, Ontario  
M9W 1R3

LIAISON OFFICER (name, location, telephone no.): Steven Radcliffe,

Waste Management Branch  
323-5188

OBJECTIVE(S): To develop a qualification standard for laboratories analyzing industrial wastes required by Ontario Regulation 309. The standard is to be developed by a consensus approach and must be capable of being used with any subsequent certification programs that the Ministry may wish to proceed with at a future date.

PROJECT DESCRIPTION: The qualification standard should be developed by a consultative process involving regulatory agencies, industry, testing agencies and other interested parties. It will need to address items such as minimum staff requirements, administrative and technical requirements of laboratories performing tests on industrial wastes.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3 *	TOTAL
Cost: (\$000's):		\$15.6	\$13.9	\$12.0	\$41.5
Work Years:		0.5	1.0	0.75	2.25

Budget Source: Waste Management Branch

KEYWORDS: Laboratory, Qualification Code, Industrial Wastes.

OUTPUT (papers, presentations, reports): CSA Standard Z201

EXTERNAL PARTICIPATION (ministries, governments, agencies): Technical committee which is developing the code by consensus, includes representatives from regulatory authorities, industry, academia, testing agencies and other interested parties.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract X                      Solicited X  
INTERNAL                      Grant                      Unsolicited

PROJECT TITLE: Wood Waste Inventory of Secondary Industries in Ontario                      PROJECT NO: PO#A05580  
START DATE: 08/88

SHORT TITLE: Wood Waste Inventory

PRINCIPAL INVESTIGATOR AND AFFILIATION: MacLaren Engineering  
D. Hickman

LIAISON OFFICER (name, location, telephone no.): D. Sparling  
Waste Management Branch  
323-5152

OBJECTIVE(S): To develop an inventory of wood residues in Southern Ontario and to identify opportunities to utilize wood waste.

PROJECT DESCRIPTION: An inventory of Southern Ontario wood residues will be developed and proposals for utilization of wood wastes will be made.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	51.0			51.0
	Work Years:	0.4			0.4

Budget Source: Ministry of the Environment - 75%, Ministry of Energy - 25%

KEYWORDS: Wood Waste Inventory

OUTPUT (papers, presentations, reports): Final Report, Data Base

EXTERNAL PARTICIPATION (ministries, governments, agencies): Ministry of Energy, municipalities, industry

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

WATER RESOURCES BRANCH PROJECTS

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RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Control of Blue-green Algae Problems  
in Southern Ontario Lakes and Reservoirs

PROJECT NO: WRB  
START DATE: 1987

SHORT TITLE: Blue-green algae control

PRINCIPAL INVESTIGATOR AND AFFILIATION:

K. Nicholls/H. Vandermeulen  
Aquatic Biology Section  
235-5810, 235-6046

LIAISON OFFICER (name, location, telephone no.):

OBJECTIVE(S): To evaluate methods of eliminating blue-green algal blooms  
using biomanipulation, physical and chemical treatment of whole  
lakes and reservoirs.

PROJECT DESCRIPTION: A variety of lake management techniques are being  
evaluated for their ability to control blue-green algae growth in several  
lakes and reservoirs in southern Ontario. These include nitrate,  
fertilization, calcium carbonate treatment, aeration/destratification and  
hypolimnetic aeration.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	\$130	\$130	\$130	
	Work Years:	1.5	2.5	2.5	

Budget Source: Water Resources Branch, Inland Lakes Programme

KEYWORDS: Blue-green algae, lake treatment

OUTPUT (papers, presentations, reports): Reports, seminars, conferences,  
journal papers.

EXTERNAL PARTICIPATION (ministries, governments, agencies):  
Ministry of Natural Resources  
Conservation Authorities

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Inferred pH/alkalinity History of Acid  
Sensitive Lakes Using Algal Remains  
("fossils") Preserved in Lake Sediments

PROJECT NO: WRB  
START DATE:

SHORT TITLE: Paleolimnology of lake acidification

PRINCIPAL INVESTIGATOR AND AFFILIATION:

K. Nicholls  
Water Resources Branch  
235-5810

LIAISON OFFICER (name, location, telephone no.):

OBJECTIVE(S): To determine the rate of change of alkalinity/pH in selected  
lakes over the past 100 years.

PROJECT DESCRIPTION: Calibration equations using three groups of organisms  
(diatoms, silica-scaled chrysophytes and chrysophyte cysts) have been  
developed for 50 Ontario lakes. These are now being applied to the down-core  
history of 8 lakes to determine the acidification rate.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	\$30.0	\$30.0	\$30.0	
	Work Years:	1.0	1.0	1.0	

Budget Source: APIOS

KEYWORDS: Acidification, paleolimnology, sediments, algae

OUTPUT (papers, presentations, reports): Reports, seminars, conferences,  
journal papers.

EXTERNAL PARTICIPATION (ministries, governments, agencies):  
Queen's University, private sector consultants

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Biosorption, Bioaccumulation and  
Food Chain Transfer of Organic  
Chemicals

PROJECT NO: WRB  
START DATE:

SHORT TITLE: Biosorption - food chain transfer

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D. MacKay, U. of Toronto  
Dr. F.A.P.C. Gobas, U. of Windsor  
Great Lakes Inst.

LIAISON OFFICER (name, location, telephone no.): Gary Johnson, MOE  
Water Resources  
Great Lakes Section  
416-323-4947

OBJECTIVE(S): To review state-of the-art research with respect to biosorption and bioaccumulation in order to enhance predictive food chain modelling.

PROJECT DESCRIPTION: The project will utilize currently available information in order to predict the extent to which organic chemicals present in the water column, partition into fish by gill or food uptake, and are transferred by food chain accumulation to higher trophic level organisms.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
Cost: (\$000's):		17.5			17.5
Work Years:		1.0			1.0

Budget Source: Water Resources Branch, Great Lakes

**KEYWORDS:** Biosorption, bioaccumulation, food chain, organic contaminants

OUTPUT (papers, presentations, reports): A report/manual and user-friendly computer program outlining simple methods to measure and calculate partition coefficients and fish bioaccumulation factors.

EXTERNAL PARTICIPATION (ministries, governments, agencies):  
See principal investigators above.

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL    X                    Contract    X                    Solicited  
INTERNAL    X                    Grant                            Unsolicited    X

PROJECT TITLE: Model Development-Food Chain

PROJECT NO: WRB87-05  
START DATE: 07/86

SHORT TITLE:    Food Chain Transfer

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.A. McCorquodale  
University of Windsor

LIAISON OFFICER (name, location, telephone no.): Peter Nettleton (323-4964)  
MOE - Water Resources Branch  
Great Lakes Section

OBJECTIVE(S): To enhance the existing food chain sub-model for incorporation into the "WASTOX" Contaminant Fate Model.

PROJECT DESCRIPTION: Studies conducted on two MISA Pilot Sites (St. Mary's and St. Clair Rivers) have collected extensive ecosystem data. Development of the food chain sub-model will provide a more realistic and accurate representation of the ecosystem, as compared with previous methods. This will enable specific data needs to be identified as well as strengthen the fate and transport models used.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	15.0	15.0	15.0	45.0
	Work Years:	0.3	0.3	0.3	1.0

Budget Source: Water Resources Branch, Great Lakes

KEYWORDS: Food chain model, fate and transport model

OUTPUT (papers, presentations, reports): Model simulation reports and scientific papers.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Contract budget is supplemented by \$50.0K of work performed by Water Resources Branch.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL		Contract	Solicited
INTERNAL	X	Grant	Unsolicited

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PROJECT TITLE: Large Lake Surveys (Inland Lakes)	PROJECT NO: WRB
	START DATE: 06/86

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SHORT TITLE: Lake Monitoring

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Bernie Neary/Greg Mierle Dorset  
Research Centre  
705-766-2418

LIAISON OFFICER (name, location, telephone no.):

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OBJECTIVE(S): (1) To survey large inland lakes (Lakes Muskoka, Joseph, Rosseau, Lake of Bays, Lake Nipissing) to assess water quality problems

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PROJECT DESCRIPTION: Ten to fifteen stations per lake mostly situated in bays will be sampled monthly. Samples will be taken from the epi-, meta- and hypolimnion for major ions. In addition, euphotic zone plankton hauls will be done and temperature and oxygen profiles will be constructed.

---

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	62.0	60.0	65.0	187.0
	Work Years:	0.5	0.2	0.3	1.0

---

Budget Source: Water Resources Branch

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KEYWORDS: water quality, nutrient, enrichment

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OUTPUT (papers, presentations, reports): "Muskoka Lakes Report: A Report of the 1986 Water Chemistry Survey"  
Water quality management plans for the affected lakes

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EXTERNAL PARTICIPATION (ministries, governments, agencies):  
MOE Central Region

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COMMENTS:  
A complementary project is being conducted by the Aquatic Biology Section  
Water Resources Branch

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL		Contract	Solicited
INTERNAL	X	Grant	Unsolicited

PROJECT TITLE: Huntsville Basin Contaminant  
Assessment Project (Inland Lakes)

PROJECT NO: WRB  
START DATE: 04/86

SHORT TITLE: Mercury in Lakes

PRINCIPAL INVESTIGATOR AND AFFILIATION: Bernie Neary/Greg Mierle Dorset  
Research Centre  
705-766-2418

LIAISON OFFICER (name, location, telephone no.):

OBJECTIVE(S): (1) To determine the cause and extent of severe mercury contamination of fish populations in the lakes surrounding Huntsville.  
2) To assess the geographical extent of contaminated fish populations, and to determine the relative concentration of mercury in streams feeding into contaminated lakes.

PROJECT DESCRIPTION: The possibility of industrial or natural geological sources of mercury are now unlikely, but will be further examined through an enhanced sediment coring programme. An analysis of the food chain structure of the lakes will be undertaken, along with estimates of unusual microbial mobilization of mercury.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	160.0	100.0	150.0	410.0
	Work Years:	0.6	1.4	1.3	3.3

Budget Source: Water Resources Branch

KEYWORDS: mercury contamination

OUTPUT (papers, presentations, reports):  
Water quality management plan(s) for the contaminated lakes.

EXTERNAL PARTICIPATION (ministries, governments, agencies):  
MOE Central Region, MNR Algonquin Region, DFO Winnipeg

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL		Contract	Solicited
INTERNAL	X	Grant	Unsolicited

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PROJECT TITLE: Rice-Sturgeon Lakes Nutrient Budget Study (Inland Lakes)	PROJECT NO: WRB START DATE: 06/86
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SHORT TITLE: Nutrient Budget

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Bernie Neary/Greg Mierle Dorset  
Research Centre  
705-766-2418

LIAISON OFFICER (name, location, telephone no.):

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OBJECTIVE(S): (1) To construct nutrient budgets for Rice and Sturgeon Lakes.  
2) To estimate the impact of potential increases in nutrient loads from the Peterborough and Lindsay STP's on lake water quality and algae and macrophyte growth.

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PROJECT DESCRIPTION: Major tributaries of both lakes will be sampled for water quality, and will have water quality measurements performed. Nutrient loads from the atmosphere will be determined from the existing ARB deposition network. In-lake sampling of water will provide estimates of in-lake cycling and nutrient variability. The response of algae and macrophyte communities will be assessed by dosing nutrients into lake enclosures.

---

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
	Cost: (\$000's):	125.0	125.0	119.0	369.0
	Work Years:	1.1	1.4	1.8	4.3

---

Budget Source: Water Resources Branch

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KEYWORDS: nutrient, budget, water quality, algae, macrophyte

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OUTPUT (papers, presentations, reports):  
Nutrient management plans for the two lakes

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EXTERNAL PARTICIPATION (ministries, governments, agencies):  
MOE Central Region, MNR, Parks Canada

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Literature Review - Acute Toxicity  
in Munisipal Sewage Effluent

PROJECT NO: WRB87-09  
START DATE:

SHORT TITLE: Toxicity Review

PRINCIPAL INVESTIGATOR AND AFFILIATION: G. Craig  
Beak Consultants Ltd

LIAISON OFFICER (name, location, telephone no.): H. Monteith,  
Water Resources Branch  
323-4901

OBJECTIVE(S): (1) To estimate the magnitude of acute toxicity problems in  
municipal STP effluent.  
2) To determine the most prevalent chemical parameters causing acute toxicity  
to aquatic organisms.

PROJECT DESCRIPTION: Acute toxicity test data developed in the past in  
Ontario STP's were assembled to determine objectives 1 and 2. U.S. EPA data  
are also being reviewed for toxicity caused by metals.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3*	TOTAL
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Cost: (\$000's):

Work Years:

Budget Source: Water Resources Branch

KEYWORDS: municipal sewage effluent, toxicity

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Report is in process of publication

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract X  
Grant

Solicited  
Unsolicited X

PROJECT TITLE: Stripping of Volatile Organic  
Contaminants - Pilot Scale Study

PROJECT NO: WRB87-02  
START DATE: 09/89

SHORT TITLE: Air Stripping Model

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Henryk Melcer  
Environment Canada  
Wastewater Technology Center

LIAISON OFFICER (name, location, telephone no.): H. Monteith,  
Water Resources Branch  
323-4901

OBJECTIVE(S): (1) To determine the operational factors affecting the  
stripping of volatile organics during sewage treatment.  
2) Optimize treatment process to minimize the stripping of volatile organics.

PROJECT DESCRIPTION: The effect of process design and operation on the  
stripping of volatile organics will be evaluated at a pilot scale plant. A  
mathematical model to describe the stripping phenomena will be  
developed/verified. Parallel studies will then be carried out at pilot and  
full-scale plants to address 'scale up' effects.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3*	TOTAL
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Cost: (\$000's):		165.0			165.0
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Work Years:

Budget Source: Water Resources Branch

KEYWORDS: volatile organic contaminants, air stripping

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Pilot-scale studies completed in summer of 1988. Parallel pilot and  
full-scale studies are scheduled for late summer and early fall.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X Contract X Solicited X  
INTERNAL Grant Unsolicited

PROJECT TITLE: Monitoring of Toxic Contaminants  
in 40 STP's

PROJECT NO: WRB87-08  
START DATE: 01/87

SHORT TITLE: Toxic Monitoring

PRINCIPAL INVESTIGATOR AND AFFILIATION: G. Zukovs  
Canviro Consultants Ltd.

LIAISON OFFICER (name, location, telephone no.): T. Ho  
Water Resources Branch  
323-4980

OBJECTIVE(S): (1) To collect the necessary data for the development of MISA  
- municipal STP monitoring and compliance regulations.

PROJECT DESCRIPTION: Daily composite samples of raw sewage final effluent and  
sludges were collected at 40 municipal STP's in Ontario. The samples were  
analysed for the presence of 180 parameters including conventional  
contaminants, trace organics and heavy metals.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	440.0			440.0

Work Years:

Budget Sources: Water Resources Branch

KEYWORDS: sewage treatment plants, effluent, sludge

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: An additional 1,160K was spent on related sampling and analysis for  
trace organics. Field monitoring was completed in 1987. A final report is  
being prepared.

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	X	Contract	X	Solicited
INTERNAL		Grant		Unsolicited

PROJECT TITLE: Stripping of Volatile Organics During Sewage Treatment - at Full Scale STP's	PROJECT NO: WRB87-08 START DATE:
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SHORT TITLE: Air Stripping

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. Henryk Melcer Environment Canada Wastewater Technology Center
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LIAISON OFFICER (name, location, telephone no.):	Hugh Monteith Water Resources Branch 323-4901
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OBJECTIVE(S): To investigate the significance of air stripping as a means of removing volatile organics during sewage treatment.

PROJECT DESCRIPTION: Composite samples of liquid sewage and off-gas were collected at the aerated grit chamber and aeration tanks (for biological treatment). Samples were analysed for the presence of volatile organics. This study was carried out at four full-scale STP's in conjunction with the 40 STPs study.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	TOTAL
	Cost: (\$000's):	210.0			210.0
	Work Years:				

Budget Sources: Water Resources Branch

KEYWORDS: air stripping, volatile organics, sewage treatment

OUTPUT (papers, presentations, reports):  
Nutrient management plans for the two lakes

- 1) Collection of Volatile Organics Emitted from Activated Sludge Systems by W.K. Bedford, J. Bell and H. Melcer, Paper presented at 23rd Canadian Symp. on Water Pollution Research, Canada Centre For Inland Waters, Burlington, Ontario, Feb. 18, 1988.
- 2) Emissions of Volatile Organics from Aerated Channels and Tanks by J. Bell and H. Melcer, paper presented at 1988 Joint Annual Conference of Pollution Control Association of Ontario and Air Pollution Control Association (Ontario SEction), Kingston, Ontario, April 17-19, 1988.
- 3) Stripping of Volatile Organic Compounds at Full-Scale Municipal Wastewater Treatment Plants by J.P. Bell, H. Melcer, I. Osinga and H.D. Monteith. Paper accepted for presentation at 1988 Water Pollution Control Federation Annual Conference, Dallas Texas, Oct. 3-6, 1988.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Report to be published as MOE report in early fall.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Anaerobic Treatment for BOD and  
Toxicity Reduction in Pulp and Paper Wastewaters

PROJECT NO: WRB  
START DATE: 1987

SHORT TITLE: Anaerobic Treatment

PRINCIPAL INVESTIGATOR AND AFFILIATION:

G. Sherbin  
Ontario Region  
Environment Canada

LIAISON OFFICER (name, location, telephone no.):

E.W. Turner  
Water Resources Branch  
323-2671

OBJECTIVE(S): To provide data on the best available technology economically achievable for the pulp and paper sector, which will be used in the development of the Effluent Limits regulation.

PROJECT DESCRIPTION: Effluents from thermal-mechanical pulping and kraft mills will be characterized. Bench and pilot scale anaerobic treatability testing will be done on these effluents; the resulting reduction in contamination and toxicity of the treated effluents will be analyzed. The next phase will include optimization of process parameters leading to, eventually, a mill site demonstration. Cost data on treatment processes will be collected.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	352.0	239.0	142.0	733.0
	Work Years:				

Budget Source: 50% Environment Canada/50% MISA

KEYWORDS: pulp, paper, Effluent Limits regulation, thermal-mechanical, kraft mills

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies): Environment Canada

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL  
INTERNAL X

Contract  
Grant

Solicited  
Unsolicited

PROJECT TITLE: Federal AOX Survey of Ontario Kraft  
Mill Effluents

PROJECT NO: WRB  
START DATE: 07/88

SHORT TITLE: Kraft Mill Effluents

PRINCIPAL INVESTIGATOR AND AFFILIATION:

G. Sherbin  
Ontario Region  
Environment Canada

LIAISON OFFICER (name, location, telephone no.): E.W. Turner

Water Resources Branch  
323-2671

OBJECTIVE(S): To provide baseline data for the concentration of Adsorbable Organically-Bound Halogen (AOX) in the final effluents from Ontario kraft mills. This data will be used to develop MISA regulations.

PROJECT DESCRIPTION: Kraft mill effluents from various stages in the manufacturing process will be sampled and analyzed for AOX. From the data, generation of AOX and their reduction through the effluent treatment process in the mill will be quantified. Along with AOX, several specific chlorinated organics in the chlorophenol and chloroguaiacol groups will also be quantified. As well, pertinent volatile organic compounds will also be quantified. As a start, two methods of AOX analysis will be compared (neutron activation and combustion/coulombetric titration).

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
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Cost: (\$000's):	60.0				60.0
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Work Years:

Budget Source: 50% Environment Canada/50% MISA

KEYWORDS: Adsorbable Organically-Bound Halogen, kraft mills, chlorophenol, chloroguaiacol

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

REGIONAL PROJECTS

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RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited X
INTERNAL	Grant	Unsolicited

PROJECT TITLE: To Map the Distribution and Determine the Species Composition and Biomass of Macrophytes in the Bay of Quinte

PROJECT NO: REQ#156832  
START DATE: 15 Apr 88

SHORT TITLE: Macrophytes in the Bay of Quinte

PRINCIPAL INVESTIGATOR AND AFFILIATION: Limnos Limited  
Private Consultant

LIAISON OFFICER (name, location, telephone no.): Jeff Overton  
Aquatic Biology Section  
Water Resources Branch  
125 Resources Road, Rexdale  
235-5803

OBJECTIVE(S):

- 1) Duplicate historic Project Quinte transsects measuring macrophyte beds.
- 2) Use LORAN navigation to determine precise location and an echo sounder to produce an accurate measurement of plant density and plant height within the water column.
- 3) Develop new transsects to better identify macrophyte distribution.
- 4) Compute macrophyte biomass and percent contribution of each species.
- 5) Compare sampling methods as to cost, accuracy, benefits and processes.

PROJECT DESCRIPTION:

The project was to duplicate the historic transsects plus add transsects parallel to the historic markers using conventional sampling of macrophytes and LORAN/sonar mapping. The results were to be correlated for accuracy. Timing of the field work was to coincide with the period of maximum biomass production and before vegetation die-off (approximately mid July). Total biomass, percent contribution of each species and percent cover were to be derived. Lastly, a cost-benefit analysis of the best methodology was to be completed.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	20			20
	Work Years:	0.50			0.50

Budget Source: Bay of Quinte Remedial Action Plan

KEYWORDS: Bay of Quinte, biomass, Project Quinte, macrophytes, species, LORAN

OUTPUT (papers, presentations, reports): Report

EXTERNAL PARTICIPATION (ministries, governments, agencies): None

COMMENTS: This work will help to design the "monitoring-surveillance" program of the Bay of Quinte Remedial Action Plan.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited X
INTERNAL	Grant	Unsolicited

PROJECT TITLE: Feasibility of Re-establishing  
Aquatic Macrophytes in the Bay of Quinte

PROJECT NO: PO/A01850  
START DATE: 22 Dec 87

SHORT TITLE: Macrophyte Re-establishment

PRINCIPAL INVESTIGATOR AND AFFILIATION: A.D. Revill Associates Ltd.  
Box 905, Belleville

LIAISON OFFICER (name, location, telephone no.): Mr. Glenn Owen  
Regional Biologist  
MOE-Southeast Region  
Kingston District Office,  
(613) 549-4000

OBJECTIVE(S):

- 1) Determine the factors influencing the loss, re-establishment and growth of aquatic vegetation in the Bay.
- 2) Trial establishment of several different species of aquatic plants to measure plant survival under changing conditions.
- 3) Determine whether large scale planting of aquatic vegetation in the Bay is feasible.

PROJECT DESCRIPTION:

The project was intended to examine the macrophyte beds in various locations around the Bay, determine which factors were influencing or restricting plant growth, and undertake an experimental transplanting of plants from areas rich in plant biomass/diversity to areas devoid or limited in plant life. The results would indicate the feasibility of large-scale transplanting and identify locations for possible future transplant work.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	5	10.055		15.055
	Work Years:				

Budget Source: Bay of Quinte Remedial Action Plan

KEYWORDS: macrophyte growth Bay of Quinte  
aquatic plant re-establishment

OUTPUT (papers, presentations, reports):  
Report - Due November 1988

EXTERNAL PARTICIPATION (ministries, governments, agencies):  
Dr. Adele Crowder, Queen's University, Kingston

COMMENTS: Phosphorus release from the Bay of Quinte is recognized as an increasingly important component of the eutrophication problem in the Bay. This work was undertaken as one option in controlling sediment disturbances and, thus, resuspension.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract X	Solicited	
INTERNAL	Grant	Unsolicited	X

PROJECT TITLE: A Survey of the Macrophytes in the Bay of Quinte	PROJECT NO: PO#A04512 START DATE: 15 May 88
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SHORT TITLE: Macrophyte mapping of the Bay of Quinte littoral zone

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. Adele Crowder Biology Department Queen's University and member of Project Quinte
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LIAISON OFFICER (name, location, telephone no.):	Fred Stride Surface Water Technician MOE-Southeast Region Kingston District Office, (613) 549-4000
--	--

OBJECTIVE(S):

- 1) Survey (map and speciation) of emergent and subemergent aquatic plants in the Bay of Quinte littoral zone.
- 2) Compare survey findings to other measurable parameters of water quality in an effort to estimate recent water quality and ecosystem changes.
- 3) Compare findings to historical biomass and species data to record recent changes in macrophyte beds in the littoral zone.

PROJECT DESCRIPTION:

Project Quinte has a number of transects for its routine water quality monitoring program. Emergent and subemergent aquatic plants in the littoral zone will be sampled along the historical transects lines three times. Estimations of plant biomass will be constructed. As well, the different species of plants will be identified. These results will be compared, to historical data, and recent changes in water quality, as measured by the extent and types of macrophyte beds, will be determined.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	7			7
	Work Years:	0.5			0.5

Budget Source: Bay of Quinte Remedial Action Plan (RAP)

KEYWORDS:	macrophyte	biomass	mapping
	littoral zone	speciation	Bay of Quinte

OUTPUT (papers, presentations, reports):  
Report (to be completed by October 31, 1988), paper

EXTERNAL PARTICIPATION (ministries, governments, agencies):  
Royal Military College - Kingston (divers-samplers)

COMMENTS: Loss of wetlands (both emergent and subemergent) continues to be a problem in the Bay of Quinte. Historically, diverse macrophyte communities were lost, via competition, to milfoil and, later, algae. Re-establishment of macrophytes may indicate an improved or healthy ecosystem. This work will measure the recent changes as an indicator of overall water quality.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract	N/A	Solicited	
INTERNAL X	Grant		Unsolicited	X

PROJECT TITLE: A Graphical Analysis of Treated and Raw Water Bacteriological Results for the Southeastern Region of Ontario, 1987

PROJECT NO: SEREG  
START DATE: 10/87

SHORT TITLE: Treated and Raw Water Bacteriological Analysis

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Art Ley  
Microbiological Scientist,  
MOE - Southeastern Region

LIAISON OFFICER (name, location, telephone no.): Dr. Art Ley  
Laboratory Services  
MOE Southeastern Region  
Kingston - (613) 549-4000

OBJECTIVE(S):

- 1) Analysis of all communal supplies of water within the Southeastern Region for bacteriological quality.
- 2) Graphical representation of step 1 to illustrate trends and changes in treated water quality, and to determine whether a deterioration in raw water quality intake translates into a deterioration of finished water.

PROJECT DESCRIPTION:

Bacteriological results for treated water were observed for percentage of monthly samples having safe, poor or unsafe quality in terms of total coliforms (TC). Bacteriological results for raw water were graphed as the number of indicator bacteria per 100 mL of sample. Findings from each test were compared and graphically illustrated to show trends and changes in treated/raw water quality. A detailed interpretation of each graph was provided.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
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Cost: (\$000's): all funding from internal budget

Work Years:	0.25	0.25	0.50
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Budget Source: Technical Support Unit, Laboratory Services

KEYWORDS: treated water, bacteriological, raw water, water quality

OUTPUT (papers, presentations, reports): Report (title as above)

EXTERNAL PARTICIPATION (ministries, governments, agencies): None

COMMENTS: Funding from existing laboratory services budget.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract N/A	Solicited	
INTERNAL	Grant	Unsolicited	X

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PROJECT TITLE: Trace Metals and Phosphorus Speciation Studies of the Sediments of the Bay of Quinte, Lake Ontario

PROJECT NO: SEREG  
START DATE: 10/87

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SHORT TITLE: Trace Metals in Bay of Quinte Sediments

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Gary VanLoon  
Chemistry Department  
Queen's University

LIAISON OFFICER (name, location, telephone no.): Murray German, Chief  
Water Resources Assessment  
Southeast Region  
Kingston District Office,  
(613) 549-4000

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OBJECTIVE(S):

- 1) To provide information on the distribution of arsenic, copper, cobalt, nickel, lead, zinc and phosphorus among the components of the Bay sediment.
- 2) Additional information to determine the process of phosphorus release from the sediments.
- 3) Understanding of each element's affect on biological productivity of the Bay.

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PROJECT DESCRIPTION:

Sediment core samples were to be collected from sites which reflect:

- 1) different types of sedimentary deposits (clay, organic oversand, organic) and, 2) different man-use on-shore impacting on local water quality. Other parameters sampled include: 1. pH, Eh and DO of the interphase water and pore water, 2. sediment description, 3. sediment particle size, 4. organic matter content of the sediments, 5. inorganic C and CaCO<sub>3</sub> contents of the sediments, and 6. sediment abundance of the fractions and predict metal mobility across the sediment solution interface under defined environmental conditions.

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BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	no direct funds; rather, manpower, expertise, equipment and supplies			
	Work Years:	0.25(0.1)+ 0.5(0.1)+			

Budget Source: Technical Support Unit, Surface Water Section  
Southeast Region, Kingston

+denotes MOE staff time

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KEYWORDS: trace metals, phosphorus, Bay of Quinte, sediments

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OUTPUT (papers, presentations, reports): Report (prepared for Project Quinte and Quinte RAP) (to be completed by October 1988)

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EXTERNAL PARTICIPATION (ministries, governments, agencies): Project Quinte - Bay of Quinte Remedial Action Plan - Queen's University, King.

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COMMENTS: MOE - Technical Support, Southeast Region funding of this project is provided in the form of manpower, equipment and supplies. No direct funds are provided.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL	Contract	N/A	Solicited	
INTERNAL X	Grant		Unsolicited	X

PROJECT TITLE: Chromogenic Reagent for E. coli PROJECT NO: 295 PL  
START DATE: 1987

SHORT TITLE: E. coli test

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Wolfe & Dr. Bowers  
Chemistry Department  
Queen's University

LIAISON OFFICER (name, location, telephone no.): Dr. Art Ley  
Microbiological Scientist  
MOE Southeastern Region  
Kingston - (613) 549-4000

OBJECTIVE(S):

To develop a method for enumerating E. coli.

PROJECT DESCRIPTION:

To synthesize and verify the utility and specificity for E. coli of indoxyl B-d-glucuronidase (IBDG).

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
	Cost: (\$000's):	internal	0		
	Work Years:	0.5	0		

Budget Source: No current budget allocated

KEYWORDS: E. coli

OUTPUT (papers, presentations, reports):

Report	Patent
Publication (Can. J. Microbiology, June 88)	Poster Presentation

EXTERNAL PARTICIPATION (ministries, governments, agencies): Queen's University

COMMENTS: Queen's University had RAC funding in 1987 to develop the E. coli testing procedure.

Current status - The research component of the project has been completed. Marketing research for application is presently underway by private firm.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



ONTARIO PESTICIDES ADVISORY COMMITTEE PROJECTS

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## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Reduction in Herbicide Use Through Cultural Control of Weeds in Lawns

PROJECT NO: OPAC-88-01  
START DATE: 4/88

SHORT TITLE: Herbicide Reduction in Lawns

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. J.F. Alex, Dr. J.C. Hall  
Dept. of Environmental  
Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): Long term: to reduce herbicide use in lawns and turf by enhancing competitive/interactive advantages of grasses through cultural practices.

PROJECT DESCRIPTION: Short term objectives:

1. Determine mowing heights and frequencies.
2. Determine optimum fertilizer regimes.
3. Determine combination of above that provide equal or greater weed control than that obtained by herbicides.
4. Maintain plots for 10 years to identify long term trends in weed population.

BUDGET AND RESOURCES:	Year: (* current)	1*	2*	3*	TOTAL
Cost: (\$000's):		13.5	29.55	29.55	13.5
Work Years:		1.7	2.4	2.4	1.7

Budget Source:

KEYWORDS: herbicide reduction, lawns, cultural control

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: • Not approved, only proposed by researcher

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Development of a Serological Assay for the Detection of Eggs and Larvae of the Parasite Poletesor ornigis Weed (Hymenoptera: Braconidae) in Spotted Tentiform Leafminer (Phyllonorycter Blancardella) PROJECT NO: OPAC-88-02  
START DATE: 4/88

SHORT TITLE: Spotted Tentiform Leafminer

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. Wayne R. Allen  
Agriculture Canada

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): To continue with the research carried out in 1987 to develop a serological assay procedure, based on monoclonal antibody technology, for reliable detection of eggs or larvae of P. ornigis in parasitized leaf miner larvae. This tool would ultimately be used by research and extension personnel for early detection and forecasting purposes.

PROJECT DESCRIPTION:

1. Characterize antibody-antigens common to eggs and larvae of P. ornigis; identify similarities to those of other parasitic wasps.
2. Select serological assay system: direct and indirect ELISA procedures will be compared with several solid phase systems.
3. Develop system to rapidly process specimens.
4. Identify suitability for routine use: effects of storage temp; time, etc.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
		87-30			
	Cost: (\$000's):	8.5	6.0		14.5
	Work Years:	0.2	0.6		0.8

Budget Source: OPAC

KEYWORDS: Spotted tentiform leafminer Pholestesor ornigis

OUTPUT (papers, presentations, reports): OPAC Symposium

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Determination of the Sensitivity to Bacillus Thuringiensis of Non-target Larval Lepidoptera Potentially Serving as Food for Young Grouse Chicks

PROJECT NO: OPAC-88-03  
START DATE: 4/88

SHORT TITLE: Non-target Larval Lepidoptera

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. Kevin N. Barber  
Sault College of Applied Arts  
and Technology

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S):

1. Identify larval lepidoptera present in shrub layer under jackpine.
2. Establish cultures of each or most abundant species. (canopies)
3. Determine relative sensitivity of B. t. to each.
4. Preliminarily describe phenologies and life histories of each, or most abundant.

PROJECT DESCRIPTION:

1. Field collect living larval Lepidoptera from various accessible sites.
2. Specimens to be segregated and reared to adult to provide positive identification of larval morphotypes.
3. Lab colony will be subject to bioassay with B. t. contaminated diet (natural, artificial or both) to determine susceptibility. (2-4 Spp to be tested).
4. Recording of collections will be kept: date, host, morphotype, etc.

BUDGET AND RESOURCES:	Year: (* current)	1*	2•	3	TOTAL
Cost: (\$000's):		10.8	12.64		10.8
Work Years:		0.5	0.62		0.5

Budget Source: OPAC

KEYWORDS: Bacillus thuringiensis, environmental impact, non-target  
Lepidoptera

OUTPUT (papers, presentations, reports): OPAC Seminar, publication

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Not approved; only proposed by researcher

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Assessment of Reduced Amounts of  
Herbicides Applied More Frequently and/or in  
Combinations to Orchard Crops to Reduce Pesticide  
Loading and Improve Control Strategies

PROJECT NO: OPAC-88-04  
START DATE: 04/88

SHORT TITLE: Herbicide Reduction in Orchards

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. R.H. Brown  
Ridgetown College of Agricultural  
Technology

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): Continue to evaluate products, rates, application frequency and  
applicable timing to reduce total herbicide load to orchards.

PROJECT DESCRIPTION: In continuation of research conducted in 1987, 1988  
research will:

1. Evaluate registered herbicides at lx and nx applications on cherries,  
apples, grapes peaches.
2. Evaluate residual herbicide combinations at reduced rates.
3. Evaluate new herbicides/herbicide combinations in orchards.
4. Apply benefit analysis to the data: yield estimates will be taken from each  
treatment to determine if herbicides themselves or degree of weed control is  
affecting yields.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3*	TOTAL
		87-02			
	Cost: (\$000's):	5.0	6.0	6.0	11.0
	Work Years:	0.3	0.7	0.7	1.0

Budget Source: OPAC

KEYWORDS: herbicide reduction, orchards

OUTPUT (papers, presentations, reports): presentations: OPAC Seminar, Western  
Ontario Fruit Testing Association

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Not approved; only proposed by researcher

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Biological Control of <u>Sclerotinia</u> <u>Sclerotiorum</u> in White Bean and Canola	PROJECT NO: OPAC-88-05 START DATE: 4/88
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SHORT TITLE: Biological Control in White Bean and Canola

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. G.J. Boland Dept. of Environ. Biology University of Guelph
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LIAISON OFFICER (name, location, telephone no.):	Dr. C.D. Fowle OPAC (416) 323-4862
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OBJECTIVE(S):

1. Evaluate selected fungal isolates for S. sclerotiorum control.
  2. Determine efficacy improvement with nutrient supplements.
  3. Investigate and identify mechanisms of action responsible for the success of selected fungal isolates.
- 

PROJECT DESCRIPTION: In 1987, lack of an adequate infection period resulted in minimum aerial infection by S. sclerotiorum; survivability of applied isolates with the exception of Trichoderma sp. was poor. In this third year of OPAC funding, sequential planting will be used to increase the probability of disease. Nutritive supplements will be examined in the greenhouse and then the field if promising. Comparisons will be made against standard fungicides. Use of electron microscopy and various lab techniques including comparative studies of effective and non-effective isolates in determining the mechanisms of action will be applied.

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BUDGET AND RESOURCES:	Year: (* current)	1 86-01	2 87-03	3*	TOTAL
	Cost: (\$000's):	9.15	14.5	16.5	50.15
	Work Years:	0.4	0.835	1.33	2.57

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Budget Source: OPAC

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KEYWORDS: white bean, canola, biological control, white mold (Sclerotinia sclerotiorum)

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OUTPUT (papers, presentations, reports): Publications, OPAC Seminar

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      Unsolicited X

PROJECT TITLE: Studies on the Relationship Between the Efficacy of Inoculum of Sclerotinia sclerotiorum and Mortality of Dandelions in Turfgrass Swards      PROJECT NO: OPAC-88-06  
START DATE: 04/88

SHORT TITLE: Dandelion Mortality

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. L.L. Burpee  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S):

1. Examine relationship between mold inoculum density and dandelion mortality.
2. Determine if S. sclerotiorum can prevent the establishment of dandelion seedlings.
3. Conduct a second year of field trials with 6 isolates of white mold.

PROJECT DESCRIPTION: Research in 1987 showed that applications of inoculum of white mold (S. sclerotiorum) at 21 day intervals can provide as much as 50% reduction in dandelions in turf; however this is significantly less than control provided by phenoxy herbicides. In 1988 it is proposed to:

- i) evaluate the relationship between inoculum density, hours of incubation at 23° C and dandelion mortality on 10 wk old dandelion plants.
- ii) expose weed free Kentucky bluegrass to inoculum and then dandelion seed; sites post seeding will receive 0, 1 and 2 applications of inoculum at 3 week intervals.
- iii) conduct a second year of field study to assess mortality of 5 and 10 wk old plants from inoculum of 6 isolates at OMAF Horticultural Research Station, Cambridge.

BUDGET AND RESOURCES:	Year: (* current)	1 86-02	2 87-04	3*	TOTAL
	Cost: (\$000's):	9.036	7.0	15.0	31.04
	Work Years:	0.8	0.8	1.0	2.6

Budget Source: OPAC

KEYWORDS: biocontrol, dandelions, turfgrass, sclerotinia

OUTPUT (papers, presentations, reports): OPAC Seminar; Guelph Turfgrass Institute Annual Report

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Development of Gypsy Moth Nuclear Polyhedrosis Virus as a Microbial Insecticide for Use in Canada                      PROJECT NO: OPAC-88-07  
START DATE: 04/88

SHORT TITLE: Nuclear Polyhedrosis Virus

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. J.C. Cunningham  
Sault College of Applied Arts  
Arts and Technology

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): Conduct efficacy trials in 1988 to enable the nuclear polyhedrosis virus to be registered in Canada under the trade name Disparvirus, to:

- 1) Determine dose of NPV providing consistent control.
- 2) Improve methodology of assessing spray applications.
- 3) Study epizootiology of naturally occurring NPV in gypsy moth populations and attempt to accurately predict when populations will collapse.

PROJECT DESCRIPTION:

- 1) Spray 3 plots (10-20 ha ea) with 2 applications of  $1.25 \times 10^{12}$  PIB/ha 3 days apart.
- 2) Several assessments will be used to determine impact: egg mass counts; larvae counts; pupae collections; larvae examinations; defoliation estimates.
- 3) Natural populations will be examined for differences and wild types bioassayed.

BUDGET AND RESOURCES:	Year: (* current)	1*	2*	3	TOTAL
	Cost: (\$000's):	11.0	16.543		11.0
	Work Years:	2.6	2.6		2.6

Budget Source: OPAC

KEYWORDS: nuclear polyhedrosis virus, gypsy moth, biocontrol

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: This is continuation of work previously funded by MNR and CFS.

•Not approved; proposed by researcher only.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Development of Methods to Monitor  
Winter Survival and Larval Establishment of Corn  
Rootworm

PROJECT NO: OPAC-88-08  
START DATE: 04/88

SHORT TITLE: Corn Rootworm

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. C.R. Ellis  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): To complete research on predicting the movement of first-instar rootworms in soil and their establishment on corn roots, and clarifying the feasibility of monitoring winter survival of corn rootworm eggs.

PROJECT DESCRIPTION: Current work is to extend the application of last year's research to:

1. Complete analysis of data collected in 1987 re larval establishment.
2. Complete the second differences between fields, determine in-field variability, consolidate operational procedures.

BUDGET AND RESOURCES:	Year: (* current)	1 (84-04)	2 (85-03)	3 (86-04)	4 (87-09)	5*	TOTAL•
	Cost: (\$000's):	15.0	18.19	17.64	18.6	21.8	40.40
	Work Years:				1.6	3.0	4.6

Budget Source: OPAC

KEYWORDS: corn rootworm, winter survival, larval migration

OUTPUT (papers, presentations, reports): OPAC Seminar, publications

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •This is for larval migration and overwintering aspect of corn rootworm only. (i.e. 2 years)

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: A Culture Protecting Corn from Western Corn Rootworm Damage: Studies of Its Minimal Protective Dose, Soil Survival, Sensitivity to Pesticides and Mode of Action

PROJECT NO: OPAC-88-09  
START DATE: 04/88

SHORT TITLE: Corn Rootworm Damage

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. P. Fitz-James  
Dept. of Microbiology & Bio-  
chemistry, Univ. of Western

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): In 1987, it was concluded that a special culture of Bacillus laterosporus (A5) had an apparent protective effect on corn from western corn rootworm. Research in 1988 proposes to investigate:

1. Minimal protective dose studies.
2. Effect of chemicals on culture.
3. Culture survival studies.
4. Mode of action studies.

PROJECT DESCRIPTION: In elaboration of objectives above.

1. (a) Conduct greenhouse pot studies to determine A5 dose needed to be effective.  
(b) Study the effect of heat on spore germination rate, both in laboratory media and soil.
2. Examine effect of chlorpyrifos, terbufos, carbofuran, etc. on A5.
3. Examine A5 survival in field situation (2 sites).
4. Examine CRW larvae as 1st target of A5; examine possible effect of A5 on larval movement.

BUDGET AND RESOURCES:	Year: (* current)	1 87-10	2*	3•	TOTAL
Cost: (\$000's):		6.0	16.0	14.103	22.0
Work Years:		0.36	1.6	1.6	1.96

Budget Source: OPAC

KEYWORDS: biocontrol, corn rootworm, *Bacillus laterosporus* culture

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Not approved; proposed by researcher only.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Studies on Dispersion of Oxyfluorfen  
and Oxidiazon and Dislodgable Residue of Pyrazophos  
and Oxyfluorfen

PROJECT NO: OPAC-88-10  
START DATE: 04/88

SHORT TITLE: Dislodgable Residues

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. R. Frank  
Ontario Ministry of Agriculture  
and Food

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S):

1. To determine the amount of dislodgable residues of pyraziphos (Afugan) and oxyfluorfen (GOAL).
2. Study dispersion of oxyfluorfen (GOAL herbicide).
3. Study dispersion of oxidiazon (Ronstar herbicide).

PROJECT DESCRIPTION:

1. Determine dislodgable and removable residues of pyraziphos from chrysanthemums: 4 stems/rep x 4 reps/sample x 3 samples x 3 dates = 36 samples (=baseline); 12 samples from washing; 12 samples from wiping.  
(b) analyse 24 samples: where 4 scouts provide gloves and covers for 1 week x 3 timings for oxyfluorfen residue analysis.
2. Analyse 24 soil samples from 87 plots and 96 samples from 1988 plots.
3. Analyse 74 soil samples (Site 1) and 36 soils; 24 onions (Site 2) collected over time to determine persistence.

BUDGET AND RESOURCES:	Year: (* current)	1 87-88	2*	3	TOTAL
	Cost: (\$000's):	5.5	6.5		12.0
	Work Years:	0.5	0.5		1.0

Budget Source: OPAC

KEYWORDS: oxyfluorfen, pyraziphos, oxidiazon, dislodgable residues, dispersion

OUTPUT (papers, presentations, reports): OPAC Seminar, report to CAPCO.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Atrazine and Metolachlor Persistence and Runoff Losses From Three Tillage Systems in Corn	PROJECT NO: OPAC-88-11
	START DATE: 04/88

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SHORT TITLE: Three Tillage Systems

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. D.J. Gaynor c/o South Western Ontario Agricultural Res. Corp.
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LIAISON OFFICER (name, location, telephone no.):	Dr. C.D. Fowle OPAC (416) 323-4862
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OBJECTIVE(S): Study the persistence, degradation and movement of atrazine and metolachlor herbicide by surface and tile drainage from 3 tillage systems. Repeat program from 1987. Site is Woodslee on Brookston clay loam.

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PROJECT DESCRIPTION: Conventional till was ploughed fall 1987. Ridge plot will be established before planting May 1988. Soil will be sampled May - November, and April '89. Water will be sampled May '88 - April '89. Analysis will be conducted 88-89. Data evaluation and report will be completed 1990.

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BUDGET AND RESOURCES:	Year: (* current)	1 (87-34)	2*	3*	TOTAL
	Cost: (\$000's):	18.0	18.8	24.275	36.8
	Work Years:	1.0	1.6	1.6	2.6

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Budget Source: OPAC

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KEYWORDS: atrazine, metolachlor, run off no-till corn, ridge planting system, conventional planting

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OUTPUT (papers, presentations, reports): OPAC Seminar.

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: •Not approved; proposed by researcher only.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant      X                      Unsolicited X

PROJECT TITLE: Mite I.P.M. in Appled Orchards  
Development of a Protocol Utilizing Pyrethroid  
Resistance and a New Synthetic Pyrethroid

PROJECT NO: OPAC-88-12  
START DATE: 04/88

SHORT TITLE: Synthetic Pyrethroid

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. R. Harmsen  
Biology Department  
Queen's University

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): How to bring together a new synthetic pyrethroid "Karate" (Chipman) which may be released later in 1988 and the introduction of Karate-resistant predatory mite into an apple orchard IBM protocol.

PROJECT DESCRIPTION:

1. Examine the relationships of prey-predator and predator-predator mite complexes.
2. Develop rearing methods for 6 mite species; conduct trial releases in 1988.
3. Establish sensitivity of various mites to Karate; compare LC<sub>50</sub>s to other synthetic pyrethroids.
4. Develop and maintain balanced mite complex in research orchard.
5. Apply Woodhouse forecasting model.
6. Extend IMP to commercial orchards.

BUDGET AND RESOURCES:	Year: (* current)	1 (87-14)	2*	3*	4*	TOTAL
	Cost: (\$000's):	5.0	5.5	5.5	5.5	10.5
	Work Years:	1.2	1.2	1.2	1.2	2.4

Budget Source: OPAC

KEYWORDS: Phytophagous mites, synthetic pyrethroid.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Not approved; proposed by researcher only.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Using Phermones as Mating Disruption Method in Order to Reduce Subsequent Larval Damage by the Grape Berry Moth	PROJECT NO: OPAC-88-13 START DATE: 4/88
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SHORT TITLE: Larval Damage by Grape Berry Moth

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	J.B. Hastings Cooper Mill Limited
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LIAISON OFFICER (name, location, telephone no.):	Dr. C.D. Fowle OPAC (416) 323-4862
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OBJECTIVE(S): Evaluate the effectiveness of phermones as a mating disruption tool in order to reduce the subsequent larval damage by grape berry moth.

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PROJECT DESCRIPTION: Two wineries will place fields at researcher's disposal. Use 990 phermones ropes/ha (400 ropes per acre) on 4 trial plots of 4 hectares each, in position mid April to guarantee disruption of 1st hatch of overwintering larvae. Use 5 therocon II sample traps per hectare; trap catches will be monitored daily; flowers and clusters will be examined for GBM damage.

1. Compare GBM damage in treated vs control.
2. Assess 2 different types of phermones dispensers.
3. Record trap catches to ascertain GBM movement throughout season and if possible establish cause of edge effect.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2*	3*	TOTAL
	Cost: (\$000's):	9.4	9.4	9.4	9.4
	Work Years:	0.6	0.6	0.6	0.6

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Budget Source: OPAC

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KEYWORDS: grape berry moth, phermones biocontrol.

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OUTPUT (papers, presentations, reports): OPAC Seminar

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS: J. Hastings was granted a federal experimental permit in 1987 to conduct such work.

•Not approved; only proposed by researcher.

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant        X                      Unsolicited X

PROJECT TITLE: Measurement of Phytotoxicity of Sub-lethal Glyphosate Deposits on Selected Woody Weed Species      PROJECT NO: OPAC-88-14  
START DATE: 04/88

SHORT TITLE: Phytotoxicity of Glyphosate Deposits

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. G. Hofstra  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S):

1. Determine the no-effect level of glyphosate on visual injury and growth of white birch, trembling aspen and alder seedlings.
2. Determine the no-effect level on physiological processes.

PROJECT DESCRIPTION:

1. Spray 100% - 1% of 2.1 kg/ha to potted tree seedlings.
2. At 2 day intervals, measure fluorescence of leaves, chlorophyll and carotenoid content, electric conductivity and visual injury.
3. Collect samples for residue analyses.
4. Follow growth pattern over 2 seasons, at the end of each growing season.

BUDGET AND RESOURCES:	Year: (* current)	1*	2*	3	TOTAL
Cost: (\$000's):		11.5	11.5		11.5
Work Years:		1.0	1.0		1.0

Budget Source: OPAC

KEYWORDS: Glyphosate, sublethal effects, woody species.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: A related project is being funded by COFRDA.

\*Not approved; proposed by researcher only.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Effects of Microencapsulated and EC Permethrin and a New Generation Synthetic Pyrethroid SAN 811-I on Stream Invertebrates	PROJECT NO: OPAC-88-15 START DATE: 4/88
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SHORT TITLE: Permethrin and Stream Invertebrates

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. N. Kaushik Dept. of Environ. Biology University of Guelph
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LIAISON OFFICER (name, location, telephone no.):	Dr. C.D. Fowle OPAC (416) 323-4862
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OBJECTIVE(S): To continue to assess the effect of micro-encapsulation on the toxicity of permethrin to aquatic invertebrates; and to determine EC<sub>50</sub> and EC<sub>90</sub> for new synthetic pyrethroid SAN 811-I under field conditions.

PROJECT DESCRIPTION: Results from 1987 were variable against lentic species; Pennacpthrin showed low toxicity to other aquatic invertebrates. To continue from 1987, field bioassays will be carried out at a suitable stream near Guelph. Selected invertebrates (Plecoptera, Ephemeroptera, Trichoptera, Diptera and Amphipoda) and black fly larvae will be exposed to a stream containing toxicant in vinyl eavestrough; values for EC<sub>50</sub> and EC<sub>90</sub> will be determined by probit analysis, effects of temperature, length of exposure, capsule size and invertebrate site on mortality will be examined. Comparative tests will be conducted on Pennacpthrin, Pennacp-M, Reldan, Reldan and Knox Out (micro encapsulated insecticides) to examine the behaviour and fate of microcapsules in aquatic environments.

BUDGET AND RESOURCES:	Year: (* current)	1 (87-15)	2*	3	TOTAL
	Cost: (\$000's):	13.5	13.5		27.0
	Work Years:	1.0	1.5		2.0

Budget Source: OPAC

KEYWORDS: Permethrin, aquatic invertebrates, constant flow bioassay.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Using Yeasts to Suppress Seed  
Production in Field Milkweeds

PROJECT NO: OPAC-88-16  
START DATE: 04/88

SHORT TITLE: Seed Suppression in Milkweed

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. G. Kevan  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): To follow up on previous research to test the efficacy of yeasts  
in preventing seed production in field milkweed.

PROJECT DESCRIPTION: The yeast, Metschnikowia reukaufii's presence in the  
nectar of common milkweed (Asclepias syriaca) highly correlates with failure of  
pollen germination. 1987 research proposed to gear up for rigorous  
experimentation on known biotypes of yeasts and milkweed in 1988: establish  
known biotypes of yeast and milkweed in the greenhouse and field; test known  
yeast cultures under highly controlled conditions of pollination; bioassay for  
virulent strains of M. reukaufii; propagate milkweed clones. The 1988 program  
is divided into 4 parts: A. Lab studies; B. Studies on milkweed biotypes;  
C. Lab and field studies on cultures and techniques; and D. Lab studies on mode  
of action and selection.

BUDGET AND RESOURCES:	Year: (* current)	1 (86-08)	2 (87-16)	3*	TOTAL
	Cost: (\$000's):	15.05	7.6	15.0	37.65
	Work Years:	1.45	0.4	1.3	3.15

Budget Source: OPAC

KEYWORDS: Biocontrol, milkweed, fertility, reduction by yeasts.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the  
Ministry. Please indicate budget source by organization (e.g., RAC,  
OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Assessment of the Potential of Aleochara bilineata for the Control of Root Maggots in the Home Garden PROJECT NO: OPAC-88-17  
START DATE: 04/88

SHORT TITLE: Root Maggot Control

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. D.G.R. McLeod  
c/o University of Western

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): To continue to assess the effectiveness of an insect predator for control of root maggot in home gardens, in onion sets, bunching onions, cabbages and radishes.

PROJECT DESCRIPTION: Both the onion maggot and cabbage maggot may be controlled by Aleochara bilineata; reliable rearing techniques are available for this parasitoid/predator. The London Horticultural Society has agreed to locate a number of home gardens for study. 32 gardens will be divided into 4 groups. A. bilineata will be released in Group B, C, & D gardens beginning April 28 with release rates of 250,500 and 1000 Ab/garden/week respectively. Group A will be controlled. 6 garden plots will also be set up at Pack's Lane Field Station of the London Research Centre, and divided into 5 groups, E releasing 2000 Ab/garden/week.

BUDGET AND RESOURCES:	Year: (* current)	1 (87-21)	2*	3	TOTAL
Cost: (\$000's):		14.7	17.2		31.9
Work Years:		0.75	2.0		2.75

Budget Source: OPAC

KEYWORDS: Biocontrol, home garden, root maggots, *Aleochara bilineata*.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Improving the Biological Control  
Potential for Gypsy Moth in Ontario Through  
Introduction of New Strains of the Parasitoid  
Cotesia melanoscela

PROJECT NO: OPAC-88-18  
START DATE: 04/88

SHORT TITLE: Biological Control of Gypsy Moths

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. V. Nealis/Dr. S. Smith  
Dept. of Biology  
University of Waterloo

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): Investigate hyperparasitism in the established gypsy moth  
parasitoid Cotesia metanoscela in Ontario and to assess the merits of  
initiating a biological control program with a new commercially available  
strain of this parasitoid which is claimed to be less susceptible to  
hyperparasitism.

PROJECT DESCRIPTION:

1. Establish colonies of principal hyperparasitoids, 2 strains of C. melanoscela and gypsy moth for field and lab experiments.
2. Investigate temporal and spatial characteristics and impact of hyperparasitism in C. m. populations.
3. Examine suitability of commercial strain of C. m. to control gypsy moth.
4. Examine relative suitability of C. m. strains to hyperparasitism.

BUDGET AND  
RESOURCES:

Year: (* current)	1*	2*	3	TOTAL
Cost: (\$000's):	12.50	12.50		12.50
Work Years:	0.67	0.67		0.67

Budget Source: OPAC

KEYWORDS: Gypsy moth, biological control, Cotesia melanoscela.

OUTPUT (papers, presentations, reports): OPAC Seminar, publications

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Not approved; only proposed by researcher.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Comparative Behaviour of Pesticides with Respect to Worker Safety. 1. Re-entry Intervals and 2. Dislodgable Residues and Pesticide Exposure to IPM Scouts from Treated Fields

PROJECT NO: OPAC-88-19  
START DATE: 04/88

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SHORT TITLE: Pesticides and Worker Safety

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PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. B. Ripley  
OMAF  
Mr. G. Ritcey  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323- 4862

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OBJECTIVE(S):

1. To identify level of residues on foliage from 9 pesticides at typical re-entry trials:
    - (a) Determine dislodgable residues for 5 insecticides and fungicides applied to strawberry or bean foliage will be analyzed over 7 timings (day 0-3).
    - (b) Foliage samples will be examined for total and dislodgable residues.
  2. Analyse patches from 4 scouts entering fields at 2 timings for a screen of pesticide residues (7 analytical procedures); swab crop foliage for residues on each occasion.
- 

PROJECT DESCRIPTION:

1. (a) 4 reps x 7 timings (1,3,5,24,48, 96 hrs post treatment) x 4 analytical methods = 112 analyses.
  - (b) 4 reps x 6 timings (days 0,1,2,3,7 and 10) x 2 parameters x 4 analytical methods = 192 analyses.
  2. Analyse 220 samples of patches from IPM scouts.
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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		9.5			9.5
Work Years:		0.8			0.8

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Budget Source: OPAC

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KEYWORDS: re-entry, worker exposure, dislodgeable residues.

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OUTPUT (papers, presentations, reports): OPAC Seminar

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

## RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Control of Spruce Budworm by Mating      PROJECT NO: OPAC-88-20  
Disruption: Effects of Different Blends of Pheromones      START DATE: 04/88

SHORT TITLE: Spruce Budworm Control

PRINCIPAL INVESTIGATOR AND AFFILIATION: Dr. J.C. Sanders  
Sault College of Applied Arts  
and Technology

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): To determine if less precise blends of pheromones are less effective in controlling spruce budworm than the precise 1976 sex pheromone (95E: 5Z) which is the current standard.

PROJECT DESCRIPTION:

1. 2 blends will be compared to the standard.
2. Each blend will be formulated in both fine and coarse formulations.
3. Field experiments through pheromone dispensers at various radii from traps will enable trap catches to be related to pheromone and particle shape.

BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
Cost: (\$000's):		9.4			9.4
Work Years:		0.4			0.4

Budget Source: OPAC

KEYWORDS: Spruce budworm, pheromone blends.

OUTPUT (papers, presentations, reports): Presentation at annual OPAC Symposium

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Further Studies on Dislodgeable  
Residues of 2,4,-D in Turfgrass Situations

PROJECT NO: OPAC-88-21  
START DATE: 04/88

SHORT TITLE: Dislodgeable 2,4-D Residues

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. G.R. Stephenson  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): In studies 1981-1984, a number of results were learned about the persistense of 2,4-D, 2,4-DP, mecoprop and dicamba. In 1988 the objective is to develop a complete set of guidelines for use that will minimize the risk of "human bystanders" which would include cultural practices such as mowing and irrigation.

PROJECT DESCRIPTION:

1. Determine impact of cutting on disappearance of physically dislodgeable 2,4-D residues.
  2. Compare dislodgeable residue disappearance of granulars vs sprays.
  3. Determine the shortest period to watering without loss of weed control.
  4. Determine effect of irrigation on dislodgeable residues.
  5. Determine effect of earliest irrigation after treatment to 2,4-D run-off.
- Outdoor plots at Cambridge Research Station will be used.

BUDGET AND RESOURCES:	Year: (* current)	1	2	3	4	5*	TOTAL
		•(81-18)	•(82-29)	•(83-19)	(84-19)		
	Cost: (\$000's):	34.5	16.28	30.0	9.3	24.0	114.08
	Work Years:		0.6	1.5	0.3	1.0	3.4+

Budget Source: OPAC

KEYWORDS: Dislodgeable residues, 2,4-D, turf grass.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Conducted in co-operation with Dr. M.K. Sears, University of Guelph.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X  
INTERNAL

Contract  
Grant X

Solicited  
Unsolicited X

PROJECT TITLE: Fate of Sulfonylurea Herbicides in  
Ontario

PROJECT NO: OPAC-88-22  
START DATE: 04/88

SHORT TITLE: Sulfonylurea Herbicide

PRINCIPAL INVESTIGATOR AND AFFILIATION:

Dr. G.R. Stephenson  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): To determine "no-effect" levels for sulfonyl urea herbicides (chlorsulfuron, metsulfuron methyl and sulfometuron methyl) on sensitive broadleaf crops, and examine persistence and leaching of chlorsulfuron (Glean) on rough turf at maximum rates for non-crop land weed control, continued from 1987.

PROJECT DESCRIPTION:

- Bioassay for activity using Guelph loam and plants seeds in styrofoam cups: alfalfa, lentils, to determine most sensitive species for Glean.
- Confirm whether "no-effect" level for chlorsulfuron is 0.01 ppb or 0.1 ppb in soil as opposed to GLC detection limit of 0.2 ppb (ug/kg soil).
- Soil sample 5 replicate plots 9, 12 and 15 months after treatment (June 30, 1987). Soil cores will be divided into 3 depths prior to analysis.

BUDGET AND RESOURCES:	Year: (* current)	1	2*	3	TOTAL
		(87-25)			
	Cost: (\$000's):	31.0	12.0		43.0
	Work Years:	1.2	0.4		1.6

Budget Source: OPAC

KEYWORDS: Mobility, soil dissipation, herbicides, chlorsulfuron, metasulfuron methyl, sulfometuron methyl.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: In 1988, analytical costs of \$5,625 will be provided by DuPont.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

PROJECT TITLE: Elimination of an Insecticide Resistent House Fly Population by Sanitation and Susceptible Fly Release	PROJECT NO: OPAC-88-23 START DATE: 04/88
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SHORT TITLE: Resistent House Fly Populations

PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. G.A. Surgeoner Dept. of Environ. Biology University of Guelph
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LIAISON OFFICER (name, location, telephone no.):	Dr. C.D. Fowle OPAC (416) 323-4862
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OBJECTIVE(S): To continue sanitation programs on a dairy farm and swine facility to show efficacy and economic return of sanitation for house fly control; release susceptible flies; monitor resistance to permethrin in fly population in Davies' barn. In 1987 it was shown \$15/week labour (3 hr/wk) can reduce needed insecticide application from daily to once per season.

PROJECT DESCRIPTION: Continue sanitation and fly release program in Davies' barn; Determine colony resistance levels; determine if the resistance level is dominant, partially dominant or recessive before (May) and after (Aug) susceptible fly release. Test effect of lime on calf bedding to reduce flies; test effect of duck foraging on maggot levels. Determine the genetics of the low level resistance yet apparent in the "wild colony".

BUDGET AND RESOURCES:	Year: (* current)	1 (85-18)	2 (86-19)	3 (87-26)	4*	TOTAL
	Cost: (\$000's):	6.957	7.826	17.5	17.99	50.27
	Work Years:	0.3	0.3	1.3	1.2	3.10

Budget Source: OPAC

KEYWORDS: Resistant house flies, sanitation control.

OUTPUT (papers, presentations, reports): Presentation for annual OPAC symposium. Paper planned for J. Econ. Entomology and article for Milk Marketing Board's Newsletter.

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: Years 1987 and 1988 address monitoring fly control in a Davies' barn through release and trapping of fluorescent-dyed susceptible flies to assist in reducing permethrin resistance in the total house fly colony. Years 1985-1988 addressed sanitation in barns as a means of total fly control.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Biological Control of Grey Mold in Strawberries                      PROJECT NO: OPAC-88-24  
START DATE: 04/88

SHORT TITLE: Biological Control of Grey Mold

PRINCIPAL INVESTIGATOR AND AFFILIATION:                      Dr. J.C. Sutton  
Dept. of Environ. Biology  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): In 1987-88, 80 potential natural biocontrol organisms for grey mold on strawberries were isolated; these included yeasts, mycelial fungi and bacteria. Each suppressed B. cinerea on the flowers and fruit but none on the leaves. In 1988-89 it is proposed to start to examine the effectiveness of these organisms for B.c biocontrol, examine the effect of simple nutrients on natural and applied biocontrol agents, examine the role of weather on biocontrol, examine optimum timing and integrate biocontrol with chemical control. Research is expected to continue for 3 years.

PROJECT DESCRIPTION:

1. Evaluate control agents: growth chambers, field.
2. Study nutrient effects: glucose, fructose, sucrose.
3. Study weather effects: growth chambers, field.
4. Study timing of biocontrol: field (3 phases).
5. Integrate biocontrol and fungicides: establish the sensitivity of biocontrol agents to Bravo and Cyprex.

BUDGET AND RESOURCES:	Year: (* current)	1 (87-27)	2*	3*	4*	TOTAL
Cost: (\$000's):		13.2	17.5	18.99	17.95	13.2
Work Years:		0.5	0.8	1.05	1.3	0.5

Budget Source: OPAC

KEYWORDS: Biocontrol, strawberries, grey mold, Botrytis cinerea.

OUTPUT (papers, presentations, reports): OPAC Seminar, publication (1991).

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Not approved; only proposed by researcher.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      X                      Unsolicited X

PROJECT TITLE: Integrated Weed Management for White Beans (Phaseolus vulgaris)      PROJECT NO: OPAC-88-25  
START DATE: 04/88

SHORT TITLE: White Bean Weed Management

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. C.J. Swanton  
Crop Science Dept.  
University of Guelph

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): Lack of weed control in white beans can result in yield losses of up to 70%. Work in 1986 and 1987 showed that total herbicide use could be reduced by as much as 60% by selective placement of herbicide in bands. Along with cultivation practices, cost savings to average grower may be \$30-85 per hectare.

PROJECT DESCRIPTION: Proposed research will define the relationship between weed density and yield loss, provide an economic model depicting this relationship for post emergent herbicides and will identify the natural competitive ability of selected crop cultivars for weed suppression.

BUDGET AND RESOURCES:	Year: (* current)	1 (86-21)	2*	3*	4*	TOTAL
Cost: (\$000's):		13.9	12.2	16.93	16.93	26.1
Work Years:		0.5	0.4	0.4	0.4	0.9

Budget Source: OPAC

KEYWORDS: Integrated weed management, white beans, post emergent herbicides.

OUTPUT (papers, presentations, reports):

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS: •Not approved; only proposed by researcher. 1987 work not funded by OPAC.

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Data Analysis and Interpretation of Pesticide Concentrations in Lichens from 45 Sites in Ontario (Upper Great Lakes Basin)	PROJECT NO: OPAC-88-26 START DATE: 04/88
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SHORT TITLE: Pesticide Concentrations in Lichens

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PRINCIPAL INVESTIGATOR AND AFFILIATION: Drs. P. Stokes/D. Whelpdale  
Institute of Environ. Studies  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

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OBJECTIVE(S): Complete analyses of organochlorine pesticide contaminants from samples collected of lichen Cladina rangiferina and Sphagnum moss at 60 select sites in triplicate around the Upper Great Lakes, in 1986 and 1987.

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PROJECT DESCRIPTION: Complete data analysis, statistics and interpretation of 2 years' collection of lichens containing 8 types of organochlorine (OC) pesticides residues. Use Lotus 1-2-3 to plot data per site. Compare OC lichen concentrations with precipitation. Conduct parallel determinations on PCBs, PAHs, and metals.

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BUDGET AND RESOURCES:	Year: (* current)	1 (86-30)	2 (87-32)	3*	TOTAL
	Cost: (\$000's):	15.0	17.0	8.0	50.0
	Work Years:	0.3	0.5	0.25	1.05

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Budget Source: OPAC, Wildlife Toxicology Fund - Atmospheric Environ. Service

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KEYWORDS: Airborne contaminants, Great Lakes Basin, lichens and mosses, bio-monitors.

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OUTPUT (papers, presentations, reports):

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant      X                      Unsolicited X

PROJECT TITLE: A New Factor to Consider in Pesticide Fate-Transport Studies      PROJECT NO: OPAC-88-27  
START DATE: 04/88

SHORT TITLE: Pesticide Fate-Transport Studies

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. P. Weinberger  
Biology Department  
University of Ottawa

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): Using the pesticide fenitrothion as a test xenobiotic, investigate the role of phytoplankton in augmenting photolytic degradation of an xenobiotic. For the most part, in the past, persistence and fate-transport studies have been carried out in laboratory microcosms devoid of plankton even though data indicates that algae are capable of mediating photobiological transformations of chemicals.

PROJECT DESCRIPTION: In continuation of the project funded under Project #86-32, work this year will, (1) provide rate constants in the presence and absence of algae and determine the action spectrum of response for the photolytic degradation of fenitrothion, (2) determine the mechanism(s) by which living and dead algae mediate augmented photolysis of fenitrothion in natural waters, (3) pinpoint the mechanism(s) involved in these phenomena and relate to the T1/2 for persistence of fenitrothion derived from the literature and used for registration purposes.

BUDGET AND RESOURCES:	Year: (* current)	1 (86-32)	2* (88-27)	3	TOTAL
Cost: (\$000's):		9.5	10.0		19.5
Work Years:		1.0	1.0		2.0

Budget Source: OPAC

KEYWORDS: Fenitrothion, half-life, degradation, Chlamydomonas sp, election transfer activity.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).

RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X                      Contract                      Solicited  
INTERNAL                      Grant                      Unsolicited x

PROJECT TITLE: Evaluation of the Use of Subterranean Termite Attractants to Synergize Soil Termiticide Applications in Structural Pest Control      PROJECT NO: OPAC-88-28  
START DATE: 04/88

SHORT TITLE: Attractants for Termite Control

PRINCIPAL INVESTIGATOR AND AFFILIATION:      Dr. J. K. Grace  
Faculty of Forestry  
University of Toronto

LIAISON OFFICER (name, location, telephone no.): Dr. C.D. Fowle  
OPAC  
(416) 323-4862

OBJECTIVE(S): This is the first year of two year study to identify likely attractants and toxicants, develop laboratory bioassays, and evaluate the potential for integrating selected behaviour chemicals and soil pesticides in remedial control.

PROJECT DESCRIPTION: 1988 work will produce decayed wood samples, develop bioassay procedures. Termites and decayed wood will be collected from the field and cultured for basidiomycete decay fungi. Likely attractants will be obtained from solvent extracts and dose response relationships will be developed to ascertain optimum attractants, and the possibility of manipulating the orientation of foraging populations.

BUDGET AND RESOURCES:	Year: (* current)	1* (88-28)	2	3	TOTAL
	Cost: (\$000's):	14.7	14.7		14.7
	Work Years:				

Budget Source: OPAC

KEYWORDS: Termite, attractants, behavioural chemicals.

OUTPUT (papers, presentations, reports): OPAC Seminar

EXTERNAL PARTICIPATION (ministries, governments, agencies):

COMMENTS:

NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



RESEARCH AND TECHNOLOGY INVENTORY: 1988

EXTERNAL X	Contract	Solicited
INTERNAL	Grant X	Unsolicited X

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PROJECT TITLE: Potential for Using Egg Parasitoids Such as <u>Trichogramma</u> Against Epidemic Populations of Forest Tent Caterpillar	PROJECT NO: OPAC-88-29 START DATE: 07/88
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SHORT TITLE: Forest Tent Caterpillar Control

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PRINCIPAL INVESTIGATOR AND AFFILIATION:	Dr. S.M. Smith Faculty of Forestry University of Toronto
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LIAISON OFFICER (name, location, telephone no.):	Dr. C.R. Harris OPAC (519) 645-4452
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OBJECTIVE(S): The purpose of this research is to investigate and assess the potential for using egg parasitoids such as Trichogramma to prevent or suppress epidemic populations of forest tent caterpillar. This will be accomplished through field and laboratory studies.

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PROJECT DESCRIPTION: The proposed study will assess the potential for using egg parasitoids such as Trichogramma spp., to suppress outbreak or increasing populations of forest tent caterpillar, Malacosoma disstria Hubner. The work will include a summer field study (1988) to determine temporal availability of forest tent caterpillar eggs to parasitism, field work to determine egg parasitoid abundance, distribution and laboratory research to determine host age acceptability and parasitoid developmental characteristics. Positive results will aid in the control of epidemic forest tent caterpillar populations, as well as enhance the progress of research on biological control agents.

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BUDGET AND RESOURCES:	Year: (* current)	1*	2	3	TOTAL
	Cost: (\$000's):	9.049			9.049
	Work Years:	1.5			1.5

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Budget Source: OPAC

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KEYWORDS: Parasitoids, Trichogramma, Forest Tent Caterpillar.

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OUTPUT (papers, presentations, reports): Presentation at OPAC Seminar

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EXTERNAL PARTICIPATION (ministries, governments, agencies):

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COMMENTS:

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NOTE: "External" refers to projects carried out by investigators outside the Ministry. Please indicate budget source by organization (e.g., RAC, OPAC, Branch, etc.).



DATE DUE			